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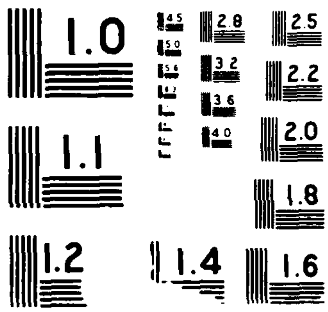
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AIR COMMAND
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STUDENT REPORT

MINIMUM RISK/PLANNING FORCE HANDBOOK

MAJOR DAVID A. ROODHOUSE 88-2255

"insights into tomorrow"

DTIC ELECTE JUN 1 6 1988

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This report first justifies and then sets forth a handbook useful for producing Major Command (MAJCOM) Minimum Risk Forces and the USAF Planning Force. Both types of forces respond to Joint Chiefs of Staff tasking to forecast force requirements for meeting a future threat. These efforts are comprehensive and complex, spanning all current USAF mission areas as well as capabilities and missions not yet operational. The results of this year-long process are reviewed by the Air Force senior leadership including the Air Force Chief of Staff and the Secretary of the Air Force. Once approved, the Minimum Risk/Planning Force Handbook will be published by HQ USAF as an unclassified guide for constructing those forces.

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PREFACE

This student report first justifies and then sets forth a handbook useful for producing Major Command (MAJCOM) Minimum Risk Forces and the USAF Planning Force. Both types of forces respond to Joint Chiefs of Staff tasking to forecast force requirements for meeting a future threat. These efforts are comprehensive and complex, spanning all current USAF mission areas as well as capabilities and missions not yet operational. The results of this year-long process are reviewed by the Air Force Board Structure at the Pentagon, by the participating MAJCOM commanders, by the Air Force Chief of Staff, and by the Secretary of the Air Force. The appendix to this report, with its associated annexes, will be published as an unclassified HQ USAF handbook for constructing Minimum Risk and Planning Forces.

It is more than appropriate to offer the author's appreciation for two individuals, without whose efforts this report would have been impossible. First, the author thanks Major Donald M. Ottinger of the 3824 STUS for his patient and thorough advice. His insightful comments and skillful editing vastly improved this report during the course of several rewrites and a great deal of discarded paper. The author also thanks his understanding wife, Carol, for her sympathetic ear and editorial efforts during the hectic weeks leading up to project completion.

ABOUT THE AUTHOR

Major David A. Roodhouse is a 1973 distinguished graduate of the United States Air Force Academy, majoring in physics and computer science. He completed pilot training at Moody AFB, GA. Major Roodhouse's first operational assignment was flying A-7D aircraft in the 356th Tactical Fighter Squadron at Myrtle Beach AFB, SC. He transitioned to A-10 aircraft at Myrtle Beach and was the first lieutenant to fly that aircraft. Next, Major Roodhouse was transferred to RAF Bentwaters, UK to open the first A-10 squadron in Europe--the 92nd Tactical Fighter Squadron. He attended the USAF Fighter Weapons School during this tour. Major Roodhouse was reassigned to Davis-Monthan AFB, AZ where he instructed aspiring A-10 pilots as a member of the 355th Tactical Training Squadron. Next, Major Roodhouse attended the Air Force Institute of Technology (AFIT) School of Engineering in residence, gaining a Masters Degree in Operations Research as a distinguished graduate. His subsequent assignment was to the Tactical Forces Division in the Air Staff Directorate of Plans (AF/XOXFT). Major Roodhouse was reassigned to the Air Command and Staff College in 1987 and will graduate in June of 1988.

While an air operations staff officer at the Air Staff, Major Roodhouse was heavily involved in constructing the USAF Planning Force. He assisted with initial computer applications during his first months on the Air Staff. During the next cycle, Major Roodhouse was appointed the deputy project officer. He coordinated most of the administrative details for running a worldwide planning conference, coordinating MAJCOM Minimum Risk Force briefings to the Air Force Board Structure, calculating the USAF Planning Force with a new spreadsheet he developed, and briefing all of the participating MAJCOM commanders to include PACAF, AAC, TAC, CENTAF, SAC, AFSPACECOM, USAFE, and MAC. The cycle was completed after briefings to the Air Force Board, the Air Force Council, the Air Force Chief of Staff, and the Secretary of the Air Force. During the following year, Major Roodhouse was the primary project officer for an off-year update which revamped Planning Force calculations to their present form and included briefings to the Air Force Board Structure and the Force Structure Committee (FSC).

In addition to the advanced degree from AFIT, Major Roodhouse has pursued several other academic and professional military education courses. He earned a Masters of Business Administration from Golden Gate University in 1983. Major Roodhouse completed Squadron Officers School by correspondence and attended in residence in 1978, finishing as a distinguished graduate and voted the top contributor by his section mates. Major Roodhouse completed Air Command and Staff College by correspondence in 1981 and was an outstanding graduate of the Air War College seminar program in 1987.

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Chapter One

INTRODUCTION

The general who wins a battle makes many calculations in his temple before the battle is fought. The general who loses a battle makes but few calculations beforehand. Thus do many calculations lead to victory, and few calculations lead to defeat (3:1). . . .

Sun Tzu

SITUATION

The year is 1999; the situation is tense. Widespread turmoil in Eastern Europe and the Middle East has the Soviet Politburo on edge. Finally, the chairman of the Communist Party of the Soviet Union (CPSU) recommends military action. With reluctance, the Politburo agrees and embarks on what will surely become World War III. With this knowledge, the Kremlin settles on preemptive conventional strikes in the Middle East, Western Europe and elsewhere in the free world. Their thought is--"Not this time. Nyet, this time _we_ take the initiative."

While this situation is hypothetical, each major conflict of the 20th century may have been viewed as equally improbable and with similar detachment. Inventors of new and more lethal weapons were convinced that their innovations had made war irrational, therefore there would be no more war. Optimists in all countries have held that war itself is irrational and therefore is unlikely. Unfortunately, conflicts have occurred. Responsible military staffs must plan accordingly.

Military planning has taken place since armed conflict began. This planning takes place on at least two levels--(1) determining how particular battles will be fought (tactical planning) and (2) developing the forces required to fight the battles (strategic planning). The former can be either long- or short-term while the latter is usually long-term. It takes a long time to develop and produce new military hardware. This time delay has expanded in today's era of technologically advanced weapon systems. The time lag makes effective planning all the more necessary.

The U.S. Joint Chiefs of Staff (JCS) recognize the requirement for strategic planning. In fact, planning is embedded throughout the Planning, Programming, and Budgeting System (PPBS) itself. One of the first steps in the PPBS process is to determine how many tanks, airplanes, and ships are needed to counter the anticipated threat (4:13; 7:5-8). In the hypothetical situation posed here, future projections of enemy force structure are needed. While the military force of any nation is developed under real-world constraints, the most prudent force developed to counter a specific threat would not be constrained by financial resources (4:16). However, it would be limited to weapons which will be technologically feasible by the time of the planning year. All of this is accomplished in a JCS-directed planning exercise referred to as the JCS Planning Force (4:16; 7:5-6). It is the preparation of the USAF portion of this force that serves as the subject of this research report and accompanying handbook. Before proceeding, some basic definitions will prove helpful throughout the remainder of the report.

DEFINITIONS

This section provides brief definitions of Minimum Risk Forces, the USAF Planning Force, and related force structures.

Minimum Risk Forces

Minimum Risk Forces (MRFs) are sized by the warfighting commanders in chief (CINCs) to defeat the future threat with minimum risk or a "virtual assurance of success" (i.e., no risk). Stated another way, additional forces would not measurably decrease risk. These forces tend to be very large. MRFs are fiscally, politically, and industrially *unconstrained* (4:16; 7:5-7).

USAF Planning Force

Using the CINCs' concepts of operation as embodied in their MRFs, the service staffs (the Air Staff in this case) prepare Planning Forces (PFs) which will defeat the threat with a "reasonable assurance of success." This is done by using more optimistic planning factors and eliminating redundancy between Minimum Risk Forces. The military service staffs calculate consolidated requirements. These consolidated requirements become the service Planning Forces and are submitted to the Organization of the Joint Chiefs of Staff (OJCS). While still quite large, this force is smaller than the combination of Minimum Risk Forces. The PF is fiscally, politically, and industrially *unconstrained* (4:16; 7:5-7).

Programmed Force

The Programmed Force is produced by the Air Staff by weighing the "benchmark" provided by the Planning Force against the dollars available. This is the force represented in the Program Objective Memorandum (POM) submitted by the military services to the Office of the Secretary of Defense (OSD) as the Programming portion of the PPBS. The Programmed Force is both fiscally and politically *constrained* (7:5-8).

Current Force

The Current Force is what is on hand today. Assuming no budget cuts, the Programmed Force will become the Current Force for any particular year in question.

With these definitions, the need for force structure planning becomes more evident.

WHY BUILD A PLANNING FORCE?

Why go through this process? First, the Organization of the Joint Chiefs of Staff requires inputs from the various service staffs (Air Force, Army, Navy, and Marines) every two years when producing their JCS Planning Force. The JCS Planning Force finds its way into the Joint Strategic Planning Document (JSPD) which is the JCS strategic plan for force development (4:15-16). Second, the Minimum Risk and Planning Forces serve as marks on the wall for force development. Fiscal constraints may well prevent the US Armed Forces from ever attaining Planning Force levels, but the shortfall represents the risk between current forces, projected forces, and forces required to defeat the anticipated threat. This is a two-edged sword. The Planning Force can be used as a vehicle arguing for changes in force structure, or as a means of examining potential strategy-force mismatches. In any event, this section has provided definitions and background required to assess the need for a Minimum Risk/Planning Force Handbook.

Chapter Two

ASSESSMENT OF NEED

> Very few of the multitudes of volumes about US air *operations*. . . even mention the *plans* and strategic purposes behind the American air operations (1:xi).
>
> Maj Gen Haywood S. Hansell, Jr.
> Architect of WWII Strategic Bombardment
> (emphasis in original)

A COMPLEX PROCESS

The introductory portion of this chapter will highlight the complexity of building either Minimum Risk or Planning Forces. This will be followed by sections dealing with personnel turnover, desired content of a MRF/PF Handbook, and planning as it has been conducted in the past. The last section dealing with the past serves as a literature search, with the dual purpose of drawing parallels with today's planning process and showing how the planning process has evolved.

It would seem fairly easy to size force structures which are fiscally, industrially, and politically unconstrained, but quite the opposite is true. The first obstacle is projecting the threat 10 years in the future. Air Force Intelligence and the Defense Intelligence Agency work throughout the year preparing these projections. Next, the planner must assess how much of that threat must be destroyed to accomplish the military mission. In many cases, the entire target set does not need to be destroyed. Calculating the portion that must be destroyed is no trivial task. Once the target set has been narrowed down, the Air Force planner must decide which weapon systems will go against selected targets, how the logistics support for that system will be deployed to the theater, air refueling requirements (if any), and a myriad of other details involved in "fighting the war." With literally hundreds of different target categories ranging from tactical to strategic, the planner has almost countless combinations to decide upon. Another layer of complexity arises if particular target categories are split between tactical and strategic weapon systems. The next step is to determine valid planning factors detailing sortie rates, attrition rates, and kill effectiveness. These factors must then be applied in mathematically valid ways. As if the mechanics of building the force were not enough, there is even a political aspect to these "politically unconstrained forces." If the Planning Force sized in one theater goes up while it decreases in another theater, high level questions frequently result. This is also the case for substantial changes in overall force levels from year to year. All of this would be of little consequence if the product was only used by the staffs producing them, but the CINCs (or their immediate deputies), the Air Force Board Structure, the Air Force Chief of Staff, and the Secretary of the Air Force personally review this force. Perhaps this description can convey in some fashion the "high stakes" involved in a complex project. This complexity aggravates the problem posed by personnel turnover.

PERSONNEL TURNOVER

By the nature of staff assignments and personnel rotations, there is a great deal of turnover in Minimum Risk/Planning Force personnel. During a typical planning year, as many as half of the key personnel will be new to the job. This is true at both Major Command (MAJCOM) and Air Staff levels. This lack of continuity can have one of two results--(1) an inordinate amount of effort to produce a quality product, or (2) an inferior product. The MRF/PF Handbook located in the Appendix was produced to minimize the first result while avoiding the second.

A natural question at this point is "What should go in a MRF/PF Handbook?" The answer was determined by an informal telephone poll of potential users and the views of the author.

INFORMAL TELEPHONE POLL

An informal poll of MAJCOM and Air Staff agencies was conducted to determine the need for a Minimum Risk/Planning Force Handbook and its contents. It was interesting to note that about half of the project officers contacted had no experience in producing either Minimum Risk or Planning Forces in spite of only five months since the conclusion of the last planning exercise. While there were relatively few specific comments, those that were received are presented in the following sections.

HQ AFLANT/XPFA

HQ TAC is the Air Force component of USLANTCOM and is designated AFLANT. The HQ AFLANT/XPFA point of contact is Major Tom Schmitt. While having a relatively small area of responsibility in the Caribbean Basin and several islands in the Atlantic Ocean, HQ TAC represents all USAF tactical commands in many respects. As such, HQ TAC inputs were used to expand on earlier comments from HQ USAFE and HQ PACAF. The concept of a Minimum Risk/Planning Force Handbook was endorsed, not only for AFLANT, but for all tactical fighter forces. Content of the handbook was left open ended. Maj Schmitt's response was "You're asking me? You're the expert (19:--)!"

HQ USCENTAF/DOXF

Lt Col Rodgers Greenawalt felt that a Minimum Risk/Planning Force Handbook would be very helpful. He suggested that the handbook should be basic in nature, assuming minimal background. Also requested were sources for the various pieces of information required to calculate Minimum Risk and Planning Forces (13:--).

HQ PACAF/XPPB

From previous conversations, Lt Col Rick King was quite interested in electronic spreadsheet applications, but did not indicate any other specific requirements for a Minimum Risk/Planning Force Handbook (15:--).

HQ USAFE/XPXF

Capt Stetson Siler currently uses an earlier version of the spreadsheets described in the Appendix. The primary need is a simply worded guide which describes the calculations in the updated spreadsheet (20:--).

HQ AFSPACECOM/XPX

Lt Col Bob Freeborn has served as HQ AFSPACECOM's point of contact for the last several years. The OPR for the AFSPACECOM Minimum Risk Force changed during the course of this writing, but Lt Col Freeborn remains the most knowledgeable individual until the next cycle is well under way. From previous conversations, Lt Col Freeborn requested some reconciliation of required inputs and timing of the AFSPACECOM Minimum Risk Force output (12:--).

HQ MAC/XPPB

Maj Mike McCarthy's input stressed HQ MAC dependence on outside inputs necessary for calculating airlift forces (17:--).

HQ AAC/XPX

From previous conversations with Lt Col Jim Holt, HQ AAC is very interested in analytical sizing methodologies, particularly involving probability of engagement of enemy bomber forces by friendly fighter forces (14:--).

HQ SAC/XPXF

Maj Harry Wurster emphasized the cooperative process used at HQ SAC to produce their Minimum Risk Force. Two methodologies are involved--(1) a nuclear attack methodology for forces capable of achieving damage expectancy goals, and (2) a methodology for calculating conventional bomber requirements. The current method of calculating the tactical fighter force could be applied to conventional bombers. Hence, a description of that methodology would assist the process (21:--).

HQ USAF/XOXFT

Maj Doug Richardson, the Air Staff Planning Force point of contact, requested a generic, unclassified definition of the USAF Planning Force. He echoed the sentiments of the MAJCOMs by considering a Minimum Risk/Planning Force Handbook most useful (18:--).

Consensus

The unanimous opinion of the individuals contacted indicated that a Minimum Risk/Planning Force Handbook should be produced. None of the individuals contacted was aware of a simply worded, unclassified handbook on this subject. It should be emphasized that the offices contacted represent all current major USAF mission areas. This ranges from strategic to tactical, from deployment to employment, from the use of space to maritime mining. In this era of specialization, comprehensive force plans require additional effort to comprehend, calculate, and then advocate. The predominate feeling among the officers contacted was that a handbook could go far in describing the interaction of such diverse forces as well as simplify their calculation. It was very clear that broad-brush, general coverage of the Minimum Risk/ Planning Force process should be the primary emphasis. Detailed explanations should be relegated to various attachments to the handbook on an as-required basis.

HANDBOOK CONTENT

This section combines MAJCOM and Air Staff inputs with the thoughts of the author, laying out the format of the Minimum Risk/Planning Force Handbook located in the Appendix.

The Author's Credentials

For his observations, the author drew on two years' experience with the USAF Planning Force. First, he performed all calculations for an update to FY 88-95 USAF Planning Force. Next, he served as the deputy AF/XOX MRF/PF point of contact (POC) for the FY 90-97 USAF Planning Force, performing all tactical fighter calculations, assembling briefing materials, assisting in briefings to the warfighting CINCs and their staffs, and backing up the AF/XOX MRF/PF POC during briefings to the Force Structure Committee, the Program Review Committee, the Air Staff Board, the Air Force Council, the Air Force Chief of Staff, and the Secretary of the Air Force. During this cycle, the author developed the spreadsheet currently in use at HQ USAFE. He coordinated Air Staff comments and inputs for the JCS Planning Force as published in the Joint Strategic Planning Document Supporting Analysis, Part III. Finally, the author was the AF/XOX MRF/PF POC for an off-year update conducted in CY 87. This included running a worldwide planning conference, updating the computational methodology, calculating tactical fighter forces, assembling Planning Force inputs from each mission area, and briefing the results to the Force Structure Committee. He derived the sizing formula described in the handbook, created the electronic spreadsheets, and captured the observations in the handbook drawn from two complete Planning Force cycles. With this information as background, the following discussion describes what should be included in a Minimum Risk/Planning Force Handbook.

Handbook Content

A single Minimum Risk/Planning Force Handbook should cater to both beginning and advanced users. The body of the handbook should treat Minimum Risk and Planning Forces in general terms, orienting the user to sources of information and the general process. This should include: (1) a compilation of source documents, (2) useful background information, (3) the relationship of Minimum Risk/Planning Force mission areas, (4) non-technical discussions of mission area methodologies and considerations, and (5) a typical schedule. Various annexes to the handbook can delve into more detail for the individuals requiring that detail. The annexes should include: (1) MAJCOM and Air Staff points of contact, (2) typical weapon systems for use in each mission area, (3) a discussion of target kill effectiveness, (4) the derivation of fighter and drone sizing formulas, (5) sensitivity analysis of the fighter sizing formula, (6) rerole of excess aircraft from one mission area to another, (7) an example using the fighter sizing formula, (8) a description of the electronic spreadsheet, and (9) helpful hints for briefing the results to the Air Force Board Structure. This information should prove very useful, but the effort would have been wasted if it was compiled in existing publications.

LITERATURE SEARCH

A check of library and staff sources revealed that no Minimum Risk/ Planning Force Handbook currently exists. However, planning has proceeded in organized fashion for many years. The first such Air Force planning was probably the work by the Air War Plans Division (AWPD) in producing AWPD-1, the production requirements plan requested by President Roosevelt prior to World War II. AWPD-1 is a prime example of effective planning. AWPD-1 and its successor, AWPD-42, transformed the controversial Air Corps Tactical School (ACTS) doctrine of strategic bombardment into a wartime strategy. Exhaustive intelligence activities had preceded this plan, identifying appropriate target bases. The vulnerability of these targets was tested extensively at the Aberdeen Proving Grounds. Finally, industrial attainability was an inherent part of this product, particularly from the viewpoint of AWPD-1--the industrial production plan (1:--). This entire process is markedly similar to the process used today in producing Minimum Risk and Planning Forces. However, the sources of information have been vastly upgraded, and the means of calculation have improved dramatically, particularly with the advent of microcomputers.

A Minimum Risk/Planning Force Handbook is needed, of this there is little doubt. Such a handbook (in draft) is located in the Appendix. The handbook deals first with general information which will be useful for the "beginner" and progresses to some detailed examples, derivations, and descriptions. As such, this effort is dedicated to those officers involved in forecasting the nation's military requirements designed to meet the worldwide threat.

APPENDIX

MINIMUM RISK/PLANNING FORCE HANDBOOK

written by

Major David A. Roodhouse, USAF

Air Command and Staff College

Class of 1988

February 1988

MINIMUM RISK/PLANNING FORCE HANDBOOK

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MINIMUM RISK/PLANNING FORCE HANDBOOK

1. Introduction

a. This handbook discusses the Commanders' in Chief (CINCs') Minimum Risk Forces (MRFs) and the HQ USAF Planning Force (PF). Source documents are discussed, followed by sections on background, general methodology, mission area methodology, and the Minimum Risk/Planning Force Conference.

b. The aim of this handbook is to summarize various tasking documents, methodologies, and schedules. This should assist MAJCOM and Air Staff planners in developing their Minimum Risk and Planning Forces. For new planners, the handbook should help in understanding the Minimum Risk/Planning Force process; for experienced planners, the handbook should serve as a concise review and reminder. For the AF/XOX MRF/PF point of contact (POC), the handbook is intended to provide the framework for the comprehensive, year-long effort. Questions concerning the Minimum Risk/Planning Forces should be addressed to:

HQ USAF/XOXF
Room 4E1021
Pentagon, D.C. 20330
Autovon 227-1127

2. Source Documents

a. Memorandum of Policy No. 84 (MOP 84): MOP 84 is a JCS document which describes the content of and schedule for the Joint Strategic Planning System. The Minimum Risk and Planning Forces are produced in response to the general tasking outlined in MOP 84 (8:--).

b. Defense Guidance (DG): The DG is the Department of Defense (DoD) strategic guidance for force planning and development. It is intended to be the culmination of the Joint Strategic Planning System. In reality, the scenarios in the previous DG are used for current-year force planning unless the scenarios change (4:13; 7:5-8).

c. Joint Strategic Planning Document Supporting Analysis, Part I (JSPDSA I): JSPDSA I kicks off the Minimum Risk/Planning Force process. It summarizes dates for submission, format of inputs, and the scenarios for force sizing (4:16; 7:5-6).

d. Joint Strategic Planning Document Supporting Analysis, Part II (JSPDSA II): Unified and specified command Minimum Risk Force inputs are compiled in JSPDSA II. Air Force component Minimum Risk Forces are included indirectly in that they are submitted to their parent unified commands. The unified command can submit the Air Force component input with no changes or submit their own force. JSPDSA II is produced to show the comparison between warfighting CINCs' MRFs and the JCS Planning Force (4:16; 7:5-6 - 5-7).

e. Joint Strategic Planning Document Supporting Analysis, Part III (JSPDSA III): OJCS/J-8 Force Planning and Programming Division (FP&P) combines the service Planning Forces into a JCS Planning Force which is included in JSPDSA III. Contentious issues between service inputs must sometimes be resolved by the Service Chiefs. As a result, force levels in the Air Force portion of the JCS Planning Force may not be the same as submitted in the USAF Planning Force (4:16; 7:5-6 - 5-7).

f. Joint Strategic Planning Document (JSPD): The JSPD provides JCS military advice to the National Command Authority (NCA) concerning force planning and development. Part of this military advice is the JCS Planning Force (4:15-16; 7:5-6 - 5-7).

g. Defense Guidance: The JSPD is used when writing the new DG, completing the cycle. See Figure 1 for a depiction of the cycle.

```
               AF                                           JCS PF
               Component  ---------------> USAF PF-------> JSPDSA III
               MRFs
                           U&S                                            New
 Old                       Command ---> JSPDSA II ---------------> JSPD -> DG
 DG --> JSPDSA I   ----> MRFs

        Jan     Mar      Apr  . . .   Jun    Oct        Apr  Jun   Sep    Dec
        |--------- Planning Year ---------------|--- Publication Year ---|
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Figure 1. Minimum Risk/Planning Force Cycle (8:8)

3. Background

a. What Is The Minimum Risk Force?

(1) Minimum Risk Forces are sized by the CINCs to execute the national military strategy in their region with a "virtual assurance of success." Additional forces would not measurably reduce risk. Minimum Risk Forces are *fiscally, industrially, and politically unconstrained* (4:16; 7:5-7).

(2) Air Force components of unified commands prepare inputs for the Air Staff and their unified commands. Air Force specified commands make inputs directly to OJCS and the Air Staff. The Air Staff takes the AF component and AF specified command inputs and produces the USAF Planning Force. The DG outlines general U.S. strategies, theater priorities, and theater objectives. As an adjunct to the DG, JSPDSA I provides assumptions for Minimum Risk and Planning Force development in the form of strategy and force planning guidance. The CINCs use the Defense Guidance, as it pertains to their specific region, to size their Minimum Risk Forces against the future threat.

(3) Calculations of Minimum Risk Forces use more conservative estimates of weapon systems effectiveness, weapons availability, sortie rates, and attrition rates. MRFs use more traditional strategies, tactics, and employment concepts.

b. What Is The Planning Force?

(1) The Planning Force is a force that can provide "reasonable assurance for successful execution" of the national military strategy. The PF is *fiscally, industrially, and politically unconstrained* (4:16; 7:5-7).

(2) The Planning Force is produced annually and briefed biennially to the USAF CINCs and Component Commanders for their comments and concurrence. It is approved by CSAF and SecAF as the official statement of force requirements to execute the national strategy with a reasonable assurance of success. The Planning Force is combined with other Service inputs biennially to form the JCS Planning Force. The USAF Planning Force is produced annually to maintain corporate knowledge of the Planning Force process. The Planning Force serves as a benchmark to assess risk inherent in the smaller Programmed Force.

(3) Four processes are used to consolidate the Minimum Risk Forces into a single Planning Force. The Planning Force is developed by eliminating redundancy, prioritizing missions, sequencing force employment, and accepting more risk.

(4) Planning Force calculations use more optimistic estimates of newer weapon systems, munitions, and sortie generation capability. They permit use of less traditional strategies, tactics and concepts of employment.

(5) The Planning Force serves as a benchmark for producing the *fiscally and politically constrained* Programmed Force (4:16).

4. Mission Areas

a. This section discusses how to produce the Minimum Risk and Planning Forces in descriptive terms. Later sections and annexes will cover more specifics in the form of quantitative methodology. Each mission area will be discussed in varying amounts of detail. Minimum Risk/Planning Force mission areas are summarized in Table 1.

Theater Forces	Recce/ Surveillance	Airlift	Strategic Forces	Space Systems
Tactical Fighters	Reconnaissance	Intra-Theater	Strategic Offense	On-Orbit Control
Electronic Combat	Surveillance	Inter-Theater	ICBMs	Space Transport
Nonstrategic Nuclear Forces			Bombers*	Meteorological Observation
Special Ops Forces			Tankers*	Communications
Combat Rescue			C^2	Navigation & Positioning
Tactical C^2			Strategic Defense	
			C^2	
			Ballistic Missile Defense	
			Atmospheric Defense	
			Space Defense	

* Conventionally tasked and SIOP

Table 1. Minimum Risk/Planning Force Mission Areas (9:--)

b. This section continues with a discussion of each mission area. Points of contact at the MAJCOMs and the Air Staff are located in Annex A.

(1) TACTICAL FIGHTERS. See Annex B for a list of weapon systems sized for the tactical fighter forces, as well as the other mission areas.

(a) Annex H describes the electronic spreadsheets used to calculate tactical fighter Planning Force requirements. These calculations are based on the following factors, concepts, and methodology.

(b) For the Tactical Fighter Planning Force, the Air Force Planning Guide, Vol III, Threat (AFPG III), published by AF/XOXFW, Mission Area Analysis (MAA), provides the target base which must be destroyed to attain a "reasonable assurance of success." MAJCOM planners may find it prudent to increase the target base to reduce risk (4:19; 5:--).

(c) The next step is assessment of the weapons systems to be used against the targets. By its charter, the Planning Force assumes no fiscal constraints while pushing technology to the limit. This permits use of technologically feasible weapons which may not actually end up in the inventory in future years. For the Planning Force, the current guidance is to employ weapon systems with validated Statements of Need (SONs) or Justification of Major Systems New Starts (JMSNSs). The Minimum Risk Forces should apply more stringent criteria, using a realistic mix of current munitions and weapons systems.

(d) Once the target base and the weapon systems/weapons have been established, the process becomes one of determining effectiveness against target types and a resulting number of required sorties/expenditures. Effectiveness depends on the number of kills per sortie for a given weapon system/weapon/target combination and the partial sortie effectiveness of the weapon system.

1. The number of kills per sortie can be determined from several sources. Joint Munitions Effectiveness Manuals (JMEMs) methodology is one alternative. See Annex C for more details.

2. Next, Partial Sortie Effectiveness (PSE) figures are required. PSEs can be thought of as degradations in weapon system performance short of actual system attrition due to less than perfect conditions. PSEs are available from AF/XOXFW, Mission Area Analysis (MAA) (10:--).

3. With the target set, weapon system kills per sortie, and partial sortie effectiveness figures, the number of sorties for each target category can be calculated. The next step is to account for attrition in the calculations.

(e) Attrition can be factored into the calculations in several ways. Basic attrition factors for many weapons systems, theaters, and missions are available in USAF War and Mobilization Plan, Vol 5 (WMP-5) (4:21; 6:--). One method of applying these figures would be to attrit systems on a sortie-by-sortie basis. Each "launch" or "wave" would result in an expected number of returning systems based on attrition rates from WMP-5. This method would require extensive amounts of computer time, but is the most rigorous. An alternative method would aggregate the number of sorties flown during a 1-day period and calculate the attrition losses for the day. Calculating attrition on a day-by-day basis could still entail significant amounts of computer time. This is the current method (somewhat modified) used by the USAF Planning Force. More simple still, sortie capabilities can be calculated for an entire phase by using average attrition and sortie rates. Either of the last two options become much easier if calculated by an analytical formula. Annex D discusses the derivation of this formula while Annex G depicts an example sizing calculation. In addition to the factors already discussed, the analytical formula requires sortie rates and the length of the campaign. WMP-5 is the source for sortie rates while AFPG III specifies the length of the campaign. Sensitivity analysis of the formula is shown in Annex E.

(f) Some target types do not lend themselves to an analytical solution. As an example, take the case of a small island. A small number of fighters may be able to handle a large threat spaced over several days (which is what the analytical formula does). However, the enemy may mass a raid to overwhelm the defenders. Reinforcements would not be possible due to the remote location. Prudence dictates a larger force structure. This type of force sizing is called level of effort. In general, orbit or combat air patrol (CAP) requirements are determined, using military judgment, to accomplish OPLAN tasking or defeat the worst case attack. Then numbers of systems are computed to satisfy the orbit requirements.

(g) The last topic in this section is that of reroling aircraft from mission to mission. This possibility arises because mission areas in the AFPG III are divided into Phase I and Phase II requirements with differing priorities. More details are available in Annexes F and G.

(2) ELECTRONIC COMBAT. Electronic Combat encompasses both Electronic Warfare targets and Command, Control, and Communications Countermeasures (C^3CM) targets. Target counts are drawn from AFPG III.

(a) Wild Weasel Sizing. Wild Weasels can be sized to support sorties flown by other aircraft, or they can be sized directly against that portion of total targets identified in AFPG III for destruction (hereafter, called the threat base).

(b) Drone Sizing. Drones are sized using the formula described in Annex D. The premise in drone sizing is that the threat base will determine an effective number of required drone missions. This will require more drones for a single launch than there are targets due to enroute drone failures. Once the drones engage the target, it is assumed that the threat is either catastrophically (and permanently) killed or temporarily disabled. Threats catastrophically killed are removed from the threat base; threats temporarily disabled are assumed disabled for the entire day. Therefore, only one launch of drones is required per day. More than one launch per day might be appropriate for MRFs.

(3) NONSTRATEGIC NUCLEAR FORCES. Nonstrategic nuclear forces (NSNF) are both important and sensitive. These force multipliers provide significant capabilities to the theaters. At the same time, they are the subject of arms negotiations. This is one area in which the Minimum Risk and Planning Forces may be politically constrained in spite of the definitions. NSNF fall into general categories of stand-alone missiles and weapons delivered from dual-capable aircraft (DCA).

(a) DCA. Dual-capable aircraft are drawn from the pool of tactical fighters sized against the conventional threat data base. Care must be taken to ensure that enough dual-capable aircraft exist for NSNF purposes. If not, then nuclear withhold forces must be added to the tactical fighter force to make up the shortfall.

(b) Stand-Alone Missiles. Progress on the Intermediate-range Nuclear Forces (INF) Treaty signed at the December 1987 summit must be closely monitored. While the MRFs and PF are politically unconstrained, these forces may be deleted from future MRF/PF planning efforts. This will increase the the role of DCA.

(4) SPECIAL OPERATIONS FORCES. Special operations forces (SOF) are in a state of flux due to Initiative 17 and the new unified Special Operations Command. Until specified otherwise, the U.S. Army performs special operations exclusively inside 250 NM. Theoretically, Initiative 17 also allocates all rotary-wing SOF assets to the U.S. Army. However, USAF SOF will size medium-range rotary-wing assets for the foreseeable future.

(a) Concepts of operation will receive careful scrutiny. If conventional forces are capable of accomplishing particular objectives, they should be used.

(b) SOF sizing is somewhat different from the mission areas discussed up to this point. SOF planners depend on others for their inputs since the Air Force basically provides transportation for SOF provided by other services.

(5) COMBAT RESCUE. Combat rescue forces are sized to retrieve downed crewmembers. In the past, this has been restricted to tactical fighter crew members. Inputs of downed crewmembers are done by numbers of crewmembers located in various range bands. The range bands dictate the type of systems sized.

(6) TACTICAL COMMAND AND CONTROL. Force sizing is accomplished primarily by "level of effort" which was described earlier. Once the level of effort has been determined, force sizing is accomplished simply by applying tactical command and control (C^2) planning factors available from AF/XOXFT. Unique aspects of tactical command and control are consideration of the Caribbean Radar Network for LANTCOM radars and determination of the planning factors. There is general disagreement over what the planning factors should actually be.

(7) RECONNAISSANCE/SURVEILLANCE. Reconnaissance and surveillance blend the capabilities of national, strategic, and theater assets into a single force. Theater reconnaissance responds to the number of interdiction (and other) sorties flown, primarily for determining the location of prospective targets and assessment of target damage. Otherwise, reconnaissance and surveillance requirements are sized using the "level of effort" method.

(8) STRATEGIC OFFENSE (16:--).

(a) Nuclear Forces

1. Threat. Strategic Offense uses the threat tables contained in the AFPG III.

2. Objectives. Strategic objectives, in terms of both numbers of targets and required damage, are contained in the Air Force Future Target List (AFFTL).

3. Methodology. The general process is similar for both the Minimum Risk and Planning Forces. Force size and mix combinations to achieve the required damage levels are run iteratively through analytical models. When the damage criteria have been met, force levels are recorded as the MRF or the PF input for strategic offense nuclear forces. The damage criteria can be stated as an overall damage expectancy goal or individual goals which the calculated force must achieve (the more stringent condition).

(b) Conventional Bomber Forces. The Minimum Risk and Planning Forces both use the same methodology. The target base contained in AFPG III serves as the basis for calculations. Theater planners identify the "strategic share" of this target base, and forces are sized to accomplish the conventional mission.

(c) Aerial Refueling Forces. The aerial refueling force structure is tied to the size of other elements of the MRF and PF. Standard planning factors are used for SIOP forces while theater planners identify their own offload and sortie requirements.

(9) STRATEGIC DEFENSE. Strategic defense is another area in a state of flux. When USSPACECOM was formed, the peacetime responsibility for atmospheric defense of the U.S. was shifted to 1AF at Langley AFB, VA. Consequently, force sizing is split between 1AF and AFSPACECOM since AFSPACECOM still provides Air Force inputs for strategic defense command and control, ballistic missile warning, and space defense. The primary emphasis is to interrelate the different aspects of strategic defense into a balanced, capable force structure.

(a) Atmospheric Defense. This area is sized as a level of effort as far as the concept of operations is concerned. In this area more than others, the prudent planner must carefully consider the threat when formulating the concept of operations.

(b) Missile/Space Defense. This area is also sized as a level of effort, but in a different way than atmospheric defense. Area coverage and satellite constellation requirements often dictate the required force structure for a given task. Redundancy in command and control is critical for proper operation of detection systems and employment of defense weapons. Ballistic missile warning must be responsive to provide timely information to the National Command Authority for further action. Space defense must ensure U.S. access to space.

(10) SPACE SYSTEMS. Space systems complement some of the capabilities of strategic defense. In one interpretation, space systems provide the connectivity, intelligence, and support required to operate other force structures effectively. Force sizing for space systems should consider the current state of U.S. space capabilities. As with strategic defense, on-orbit control should be redundant to the point that access to and use of U.S. space assets is guaranteed. Satellite requirements for communications, navigation and positioning, and meteorological observation are sized using the

level of effort methodology. Satellite constellation requirements are usually clearcut. The variable open to discussion is the number of on-orbit spares.

5. On-Years Versus Off-Years.

In CY 1986, OJCS changed to a new 2-year (biennial) JSPD planning cycle. As indicated in Figure 1, this roughly translates into a "Planning Year" and a "Publication Year." The MAJCOMs and Service Staffs produce their inputs in the "on-year" while OJCS analyzes the inputs and publishes the JSPD in the "off-year." CY 88 and CY 90 are "on-years" while CY 89 and CY 91 are "off-years" requiring no submissions to OJCS. In the past, the Air Staff has produced Planning Forces every year to retain corporate memory of the planning process and to respond to changing weapon systems and threats. While completely at the discretion of the Service Staffs, "off-year" exercises should parallel "on-year" efforts as much as possible. From this perspective, the following section describes the schedule for a typical "on-year."

6. Typical Schedule.

This section provides a brief discussion of Minimum Risk and Planning Force events during "on-years." The next "on-year" effort will produce FY 92-96 Minimum Risk/Planning Forces in CY 88. Minimum Risk Forces will be due 1 Apr 88 with the USAF Planning Force due 1 Oct 88. The following schedule is a suggestion only, but incorporates several years' experience of producing Minimum Risk and Planning Forces.

a. The general sequence of activities in an "on-year" includes: a planning conference; production of Minimum Risk Forces; Minimum Risk Force briefings to the Air Staff; production of the USAF Planning Force; Planning Force briefings to participating MAJCOMs; Planning Force briefings to the Air Force Board Structure, CSAF, and SecAF; and publication.

b. Early December (prior to the "on-year"). The AF/XOX MRF/PF POC should start the cycle with preliminary message traffic. Conference facilities should be secured. In past years, conference facilities at ANSER, Inc. have been used with considerable success. SAF/AQQT is the Air Force sponsor for ANSER for tactical forces. The ANSER Tactical Division point of contact is Mr. Dunell Schull, 685-3135. ANSER is located at 1215 Crystal Gateway 3, across from the Embassy Suites. Conference facilities are on the eighth floor. The AF/XOX MRF/PF POC may find historical files located at AF/XOXFT of some help in producing the various handouts, etc.

c. Early January. The AF/XOX MRF/PF POC should complete conference preparations. MAJCOM planners should review their previous year's Minimum Risk Forces.

d. Mid-January. The Minimum Risk/Planning Force Conference kicks off the planning cycle by establishing a common level of knowledge among Air Staff and MAJCOM planners. Topics covered include tasking documents, support documents, and individual mission areas. The object of the conference is for conferees to establish "handshakes" for producing the current-year forces. Production of Minimum Risk and Planning Forces is labor intensive to the point that a common point of departure is almost mandatory. If the conference is held too early, JSPDSA I will not have been published; the actual tasking for the year and the sizing scenarios will not have been established. If the conference is held too late, the planners will not have enough time to produce their forces.

e. Mid-January through Mid-March. MAJCOM planners produce their Minimum Risk Forces. These must be approved by the MAJCOM chains of command prior to release outside the MAJCOMs.

f. Mid-March. MAJCOM planners submit their Minimum Risk Forces to their unified commands; the unified commands must compile inputs from each component and submit their unified inputs to OJCS by 1 Apr for inclusion in JSPDSA II. Coincident with the submission to the unified commands, MAJCOM representatives usually return to the Air Staff to brief their Minimum Risk Forces to appropriate panels and the Force Structure Committee. See Annex I for some helpful hints for briefings at the Air Staff.

g. Mid-April. Air Force specified commands and HQ AFSPACECOM complete their Minimum Risk Force computations and brief the Air Staff. MAC, SAC, and AFSPACECOM depend on other commands for inputs prior to sizing their forces. Therefore, they get a little more time to size their forces. It should be noted that SAC did not receive a time extension for the FY 90-97 cycle, but probably should have due to the circumstances in common with MAC and AFSPACECOM. HQ MAC consolidates lift requirements for air transport of general warfighting materiel, special operations forces and materiel, and downed crewmembers. HQ SAC sizes tanker forces to support a wide variety of activities including strategic bombers (which HQ SAC controls), tactical fighters, reconnaissance aircraft, airlift, strategic defense aircraft, etc. (which HQ SAC does not control). HQ SAC must also size conventionally tasked bombers and strategic reconnaissance. HQ AFSPACECOM sizes all space-based assets with the exception of offensive space weapons. In many cases, space-based assets support the operations of theater and strategic forces sized by other MAJCOMs. In each of these cases, the unified commands provide most of the inputs. It is very difficult to convince the unified planners to speed up their planning process when their only concern is a 1 Apr suspense to OJCS. The unified commands are not very concerned about the Air Force briefing cycle, nor are they likely to become so.

h. Mid-April through Mid-May. Air Staff planners produce the USAF Planning Force using the Minimum Risk Force inputs as points of departure.

i. Mid-May. Individual mission area Planning Forces are briefed to appropriate panels and the Force Structure Committee. Then a consolidated briefing is presented to the Force Structure Committee; this briefing seeks approval to brief the Planning Force to the CINCs and AF component commanders for their comments and concurrence. This is a critical step in on-years, since the Air Force Board Structure, the CSAF, and the SecAF will be very interested in the reactions of the field commanders to the proposed force levels. The Planning Force is not likely to be approved by the Air Staff and SecAF without concurrence from the field.

j. June. The consolidated Planning Force is briefed to participating MAJCOMs. The briefings should be tailored to include detailed theater/mission area slides for the MAJCOM being briefed.

k. July through August. The consolidated Planning Force briefing is presented to the Air Force Board Structure. The briefings should be scheduled at least one week apart to allow time to make changes. This portion of the cycle starts with a briefing to the Force Structure Committee (FSC), relaying the comments from the field back to the Air Staff. This is followed by a courtesy briefing to the Program Review Committee (PRC) prior to briefing the rest of the board structure. The Air Staff Board and Air Force Council are briefed in turn.

l. Late-August through Early-September. The Planning Force is briefed to the CSAF and SecAF. This briefing is sometimes combined; the CSAF required a separate prebrief prior to the SecAF briefing for the FY 90-97 Planning Force.

m. Mid-September. Assemble slide masters and script and publish the Planning Force. The FY 90-97 Planning Force was not scripted until very near the end of the cycle. None of the FY 90-97 consolidated briefings were presented from prepared scripts. Copies are usually produced at the Air Force printing plant located on the fourth floor on corridor eight.

n. 1 Oct. Provide at least three copies of the Planning Force document to OJCS/J-8 FP&P for inclusion in JSPDSA III in the form of the JCS Planning Force. This needs to be coordinated through AF/XOJA so they know that the suspense has been met. This completes the "Planning Year" portion of the 2-year cycle. The AF/XOX MRF/PF POC can expect to be very involved with OJCS/J-8 FP&P during the upcoming "Publication Year" by coordinating on JSPDSA II, JSPDSA III, and the JSPD.

7. Minimum Risk/Planning Force Conference

a. As mentioned in Section 6, the purpose of the Minimum Risk/Planning Force Conference is to establish a common base of reference for Minimum Risk/Planning Force deliberations. The conference kicks off the year-long effort required to produce credible, approved forces for submission to OJCS.

b. Figure 2 shows a sample abbreviated Minimum Risk/Planning Force Conference Schedule from the FY91-98 "off-year" effort. The main difference between "on-year" and "off-year" schedules is the expanded amount of time devoted to each topic in "on-years." The schedule should be tailored to meet current requirements.

FY 91-98 MINIMUM RISK/PLANNING FORCE CONFERENCE

21-23 JAN 87 ANSER BUILDING

SCHEDULE

TUESDAY, 20 JANUARY 1987

Travel Day -- Time with mission area chairmen, as required

WEDNESDAY, 21 JANUARY 1987 -- Preliminary Briefings

0830-0900	Registration
0900-0915	Opening Remarks
0915-0930	Administrative Remarks
0930-1015	**BRIEFING:** Schedule Review & Min Risk/Planning Force Process
1015-1030	BREAK
1030-1100	**BRIEFING:** JCS Planning System, Defense Guidance, JSPDSA, Part I Update
1100-1145	**BRIEFING:** The 1998 Soviet Threat
1145-1330	LUNCH
1330-1430	**BRIEFING:** Changes to AFPG Vol III, Threat & Minimum Risk Force Calculations
1430-1445	**BRIEFING:** Partial Sortie Effectiveness (PSE)
1445-1500	BREAK
1500-1520	**BRIEFING:** Defense Planning Questionnaire (DPQ)
1520-1550	**SEMINAR:** Timing and Sources of Minimum Risk/ Planning Force Inputs
1630-	Social Hour

Figure 2a. FY 91-98 Minimum Risk/Planning Force Conference

FY 91-98 MINIMUM RISK/PLANNING FORCE CONFERENCE

21-23 JAN 87 ANSER BUILDING

SCHEDULE

THURSDAY, 22 JANUARY 1987 -- Short Overviews of FY 90-97 Forces, Problems Encountered, Suggestions for FY 92-99 Forces

	SEMINAR: Theater Forces
0830-0850	Tactical Fighters
0850-0910	Electronic Combat
0910-0930	Nonstrategic Nuclear Forces
0930-0940	BREAK
0940-1000	Tactical Command and Control
1000-1020	Special Operations
1020-1040	Combat Rescue
1040-1050	BREAK
1050-1110	Reconnaissance/Surveillance
1110-1130	Airlift
1130-1300	LUNCH
	SEMINAR: Strategic/Space Forces
1300-1320	ICBMs
1320-1340	Bombers
1340-1400	Tankers
1400-1410	BREAK
1410-1430	Strategic Offense Command and Control
1430-1510	Strategic Defense
1510-1520	BREAK
1520-1600	Space Systems

FRIDAY, 23 JANUARY 1987

0800-1200	Theater Spreadsheet Overview and Sample Calculations
1200-	Time as appropriate with mission area chairmen.

Figure 2b. FY 91-98 Minimum Risk/Planning Force Conference Cont'd

Annex A

MINIMUM RISK/PLANNING FORCE POINTS OF CONTACT

AIR STAFF OPR	OFFICE SYMBOL	AUTOVON/ROOM
Deputy Director for Force Development	AF/XOXF	227-4280/4E1021
Theater Forces		
Tactical Fighters	AF/XOXFT	225-4709/4A1070
Electronic Combat	AF/XOXFT	225-4732/4A1070
Nonstrategic Nuclear Forces	AF/XOXFT	225-4732/4A1070
Special Operations Forces	AF/XOXFL	225-5722/4A1084
Combat Rescue	AF/XOXFL	225-5722/4A1084
Tactical Command and Control	AF/XOXFT	225-4709/4A1070
Reconnaissance/Surveillance	AF/XOXFT	224-0481/5D175
Airlift	AF/XOXFL	225-6668/4D1084
Strategic Offense		
ICBMs	AF/XOXFS	227-6936/4D1018
Bombers	AF/XOXFS	227-6114/4D1018
Tankers	AF/XOXFS	225-6114/4D1018
Command and Control	AF/XOXFS	227-5658/4D1018
Strategic Defense	AF/XOXFD	227-6081/4A1070
Space Systems	AF/XOXFD	227-5891/4D1023

MAJCOM OPR	OFFICE SYMBOL/ADDRESS	AUTOVON
AAC	HQ AAC/XPX ELMENDORF AFB, AK 99506	317-552-4280
AFLANT/TAC	HQ TAC/XPFA LANGLEY AFB, VA 23665	574-2719/3208/3854
AFSPACECOM	HQ AFSPACECOM/XPX PETERSON AFB, CO 80914	692-3152
MAC	HQ MAC/XPPB SCOTT AFB, IL 62225	576-4671
PACAF	HQ PACAF/XPP HICKAM AFB, HI 96583	449-2846/5198
SAC	HQ SAC/XPXS OFFUTT AFB, NE 68113	271-2775/2080/2796
USAFE	HQ USAFE/XPXF APO NEW YORK 09012	480-6097
USCENTAF	HQ USCENTAF/DOXF SHAW AFB, SC 29152	965-2835/3377

Annex B

TYPICAL WEAPON SYSTEMS (9:--)

Tactical Fighter Forces
- Advanced Tactical Fighter (ATF)
- F-15A-D
- F-16A-D
- A-7+
- A-10
- A-16
- F-15E
- F/FB-111
- Wild Weasel

Electronic Combat Forces
- Wild Weasel (repeated in Tactical Fighters)
  - F-4G
  - Follow-On Wild Weasel (FOWW)
- Tactical Jamming System (TJS--EF-111)
- Compass Call (EC-130H)
- Drones
  - Expendable Jammer
  - Expendable Killer
  - Chaff/Decoy
  - Recoverable Jammer

Non-Strategic Nuclear Forces
- Ground Launched Cruise Missile (GLCM) (subject to INF Treaty)
- Air-to-Surface Missile (ASM)
- Gravity Weapons
- Programs of Cooperation (POC) Gravity Weapons

Special Operations Forces
- MC-130E Combat Talon
- CV-22 Osprey
- HC-130 Tanker for CV-22
- AC-130 Gunships
- MH-53 Pave Low
- MH-60 Blackhawk

Combat Rescue Forces
HH-60 Blackhawk
CV-22 Osprey
HC-130 (Type I tanker for CV-22)
WC-130 (Weather reconnaissance, included here for convenience)

Tactical Command & Control Forces
Airborne Warning & Control System (AWACS)
Control and Reporting Centers (CRCs)
Forward Air Control Posts (FACPs)
Tactical Air Control Center (TACC)
Air Support Operations Center (ASOC)
AirBorne Communications, Command & Control (ABCCC)
Forward Air Control (FAC) Aircraft
Tactical Air Control Parties (TACPs)

Reconnaissance/Surveillance
U-2/TR-1/Tactical Reconnaissance System (TRS)
RC-135
SR-71
Rapidly Deployable Mobile SIGINT Set (RDMSS)
Joint STARS
RF-4C
Unmanned Aerial Reconnaissance Vehicle (UARV)

Airlift
C-5
C-141B
C-130
KC-10 (use 50% of cargo cap. as offset for refueling)
C-17

Strategic Offense
ICBMs
- Small ICBM
- Peacekeeper
- MM III

Bombers
- B-52H (standoff cruise missile carriers)
- B-52G (conventional)
- B-1B
- Advanced Technology Bomber (ATB)

Tankers (reported in KC-135A equivalents)
- KC-135A
- KC-135E (1.2 KC-135A equivalents)
- KC-135R (1.5 KC-135A equivalents)
- KC-10 (3.0 KC-135A equivalents--use 1.5 as offset for cargo cap.)
- KC-X (3.0 KC-135A equivalents)

Strategic Offense Command and Control

E-4B

EC-135

EC-X

Strategic Defense

Command and Control

Cheyenne Mountain Complex

NORAD/Offutt Command Post

Survivable Command Post (EC-X)

Rapid Emergency Reconstitution Team (RERT)

Ballistic Missile Warning

Ballistic Missile Warning System (BMEWS)

Sea-Launched Ballistic Missile (SLBM) Phased Array Radar

Defense Support Program (DSP)

Mobile Ground Stations

Fixed Ground Stations

Boost Surveillance Tracking System (BSTS)

Nuclear Detonation (NUDET) Detection System (NDS)

Atmospheric Defense

Over-the-Horizon Backscatter (OTH-B)

North Warning System (NWS)

Joint Surveillance System (JSS)

Wide Area Surveillance System (WASS)

Airborne Warning and Control System (AWACS)

Region Operations Control Center (ROCC)

Sector Operations Control Center (SOCC)

Critical Asset Defense (CAD)

F-15

F-16A/B (Air Defense Competition Aircraft)

Space Defense

Alternate Space Defense Operations Center (Alt SPADOC)

Alternate Space Surveillance Center (Alt SSC)

Near Earth Radars

Deep Space Radars

Ground Electro-Optical Defense Surveillance System (GEODSS)

Space Surveillance and Tracking System (SSTS)

Satellite Assessment and Identification System (SAIDS)

Defensive/Anti-Satellite (Hi-Alt DSAT/ASAT)

Anti-Satellite Miniature Vehicle (ASAT-MV) (Low altitude)

Air Launch ASAT Extender (Alt Ext)

Ground-Based Laser (GBL)

High-Powered Radio Frequency Weapon (HPRF)

Orbital Maneuvering Vehicle (OMV) (DSAT variant)

Space Systems

- On-Orbit Control
  - Satellite Test Center (STC)
  - Remote Tracking Stations (RTS)
  - Survivable Control System (SCS)
  - Satellite Operations Complex (SOC)
  - Shuttle Operations and Planning Complex (SOPC)
  - Consolidated Space Operations Center (CSOC)
- Space Transportation
  - Space Shuttle Orbiters (DoD & NASA)
  - Upper Stages
  - Expendable Launch Vehicles (ELVs)
  - Reusable Orbiter Transfer Vehicle (ROTV)
  - Orbital Maneuvering Vehicle (OMV) (satellite repair & retrieval)
  - Military Aerospace Vehicle (MAV)
- Meteorological Observation
  - Defense Meteorological Satellite Program (DMSP)
  - Geostationary Meteorological Satellite (GMS)
- Communications, Navigation/Positioning
  - Defense Satellite Communications System (DSCS III)
  - AFSATCOM Transponders
  - MILSTAR (including control networks)
  - Global Positioning System (GPS)

Annex C

EXPECTED KILLS PER SORTIE

This annex describes air-to-ground expected kills per sortie (EKS) (also known as Blue Kills [BKs]). In general terms, EKS predicts the effectiveness of a weapon system using a particular weapon against a particular target type.

This process uses the Air Force Planning Guide, Vol III, Threat (AFPG III) (5:--) and the Selector Output for Nonnuclear Consumables Annual Analysis (SO for NCAA or SON) (11:--). The SON does not always use the maximum, realistic aircraft combat load. The planner must be familiar with sensible combat loads for each aircraft.

Example

Find: EKS of A-10 vs a tank platoon in Southwest Asia (SWA)

First, find the SWA "Targets and Objectives" table in the AFPG III. A notional extract from this table is shown in Table C-1.

```
                  Table I-4 Southwest Asia . . .

                      Target   Sub
                       Codes   Tgts . . .
                                 .
                                 .
                                 .
   1.  CAS O-FSCL                       (Notional numbers only)
    a.  Mobile Forces
     (1)  Tanks/APCs .
          Tank Platoon  28     6 (or 6 tanks per platoon)
```

Table C-1. Southwest Asia Targets and Objectives

The "Target Code" is the target's numerical designation used to locate the target in the SON (28 in this case).

Theoretically, the EKS is the maximum *sub-targets* destroyed by *one* aircraft during *one* sortie. Use "Sub Tgts" instead of total targets to avoid confusion. For this example, the fact that 6 tanks make up a tank platoon seems plausible, although the planner might not know exactly how many tanks are in a platoon. In this case, the number of tanks (or total sub-targets) gives a better feel for the size of the problem. An example where the distinction is not so clear might be a target type of aircraft parking aprons. The planner might assume that the hard surface was the object of attack when the complete target description might indicate desired targets of 40 enemy aircraft on 20-foot by 150-foot aprons. The real targets are aircraft, not parking aprons.

Returning to the tank example, find the correct page in the SON. A sample is shown in Table C-2. The headings in Table C-2 are the same as those in the actual printouts and are only important for determining aircraft type, target number, and weapon type. The important headings and numbers are shown in boldface. The target number matches that in AFPG III; the aircraft number is matched with an actual aircraft (A-10 in this case) on a separate sheet of the SON.

0AIRCRAFT	**1 TARGET 28**		ACFT REPLACEMENT COST		0.0 O&M ...	
0WEAPON	**EKS**	ATTRN	LOADOUT	COST/WEAPON (K$)	COST/KILL (K$)	
69RP78	**0.25**	0.222	**2**	0.0	5.1	**AGM-65**
67RP79	0.11	0.333	4	0.0	6.2	MK-84
65RP74	0.02	0.444	6	0.0	7.3	MK-82
62RP91	0.01	0.555	8	0.0	8.4	MK-20

Table C-2. Selector Output of NCAA

Each target *usually* has several EKS values, listed in decreasing order. Since the MRF and PF are fiscally *unconstrained*, use the highest EKS value. Therefore, 0.25 is the appropriate EKS value. With this information the math is simple. Multiply the number of sub-targets (6 tanks per platoon from AFPG III) by the EKS value (0.25 tank platoons per sortie from the SON) to find the number of sub-targets destroyed by one sortie (EKS).

EKS = 0.25 x 6

= 1.5 tanks, using 2 AGM-65s

This result might puzzle some planners. How can half a tank be killed? An EKS of 1.5 tanks per sortie can be interpreted as destroying 1 tank on the first sortie and 2 tanks on the next sortie. The average per sortie (or EKS) is 1.5 tanks.

Problems the Planner May Encounter

The SON may not always list an optimum weapons load. For example, if the SON shows the aircraft carrying one AGM-130 and the aircraft would normally carry two, simply double the EKS.

Some targets have more than one "Target Code" with more than one target description in AFPG III. Assume that a target line labeled "Tanks" has target codes "1" and "3." Upon looking up the target descriptions, it is discovered that target code "1" represents T-62 tanks and target code "3" represents T-72 tanks. These have been lumped together with no way of knowing how many of each kind there are. Refer to Tables C-3a and C-3b for the two SON extracts used for this example.

To simplify the problem, avoid mixing weapon loads. Given Target Codes 1 and 3, the best EKS against Target Code 1 is achieved by using MK-84s while Target Code 3 is best attacked with AGM-65s. First, choose the higher of the two EKS values, in this case Target Code 1 (0.75 using 4 MK-84s). Now, find Target Code 3's highest EKS for **MK-84s** (0.30 using 4 MK-84s).

OAIRCRAFT	**1 TARGET 1**	ACFT REPLACEMENT COST			0.0 . . .	
OWEAPON	EKS	ATTRN	LOADOUT	COST/WEAPON (K$)	COST/KILL (K$)	
69RP78	**0.75**	0.222	**4**	0.0	5.1	**MK-84**
67RP7R65	0.30	0.333	2	0.0	3.2	MK-84
65RP74	0.15	0.444	4	0.0	3.4	MK-20
65RP91	0.10	0.555	2	0.0	2.2	MK-20

Table C-3a. SON Output for Target 1

OAIRCRAFT	**1 TARGET 3**	ACFT REPLACEMENT COST			0.0 . . .	
OWEAPON	EKS	ATTRN	LOADOUT	COST/WEAPON (K$)	COST/KILL (K$)	
69TT84	0.50	0.666	4	0.0	3.5	AGM-65
68TT83	0.40	0.777	4	0.0	2.4	AGM-65
69TT82	**0.30**	0.888	**4**	0.0	1.5	**MK-84**
66TT81	0.20	0.999	4	0.0	1.5	Mk-84

Table C-3b. SON Output for Target 3

Since the weapons load may differ between printouts, the EKS per weapon is required next. The EKS value per MK-84 is computed as follows:

Target 1: 0.75 / 4 = 0.1875 platoons per MK-84

Target 3: 0.30 / 4 = 0.075 platoons per MK-84

With a standard A-10 weapons load of 4 Mk-84s, the EKS for each target is:

4 x 0.1875 = 0.75 platoons (for Target 1)

and

4 x 0.075 = 0.30 platoons (for Target 3)

This step could have been omitted since the munitions loads were the same for both targets. If the loadouts had been different for Targets 1 & 3, this step would have been required to determine the EKS for the "standard" load. The next step is to find a weighted average of the individual EKSs. Unfortunately, AFPG III does not describe the relative numbers of Target 1s and Target 3s making up the target set. Unless the planner has information indicating otherwise, assume that targets are split equally among individual target codes. As indicated below, the weighted average of EKS for each target type gives the aggregate EKS for the entire target line.

$$\text{EKS (Tgt 1)} \times \frac{\text{\# Tgts 1}}{\text{\# Tgts 1+3}} + \text{EKS (Tgt 3)} \times \frac{\text{\# Tgts 3}}{\text{\# Tgts 1+3}} =$$

$$0.75 \times .50 + 0.30 \times .50 = 0.525 \text{ platoons}$$

If there are 6 tanks per platoon, as in the previous example, the EKS for this target line would be:

0.525 platoons x 6 tanks per platoon = **3.15 tanks per sortie**

Other Problems

If a target is not listed in the SON for a specific aircraft, use the data from a comparable target. If there is no comparable target, use the data for a comparable aircraft for the same or comparable target. As a last resort, use the data for that target from the SON of another theater. Note that target codes for similar targets in different theaters probably will not be same.

Conclusion

While this process appears somewhat complex, most AFPG III target lines have only one target code which can be easily found in the SON. The important points are: (1) to always work in terms of sub-targets and (2) to avoid mixing weapons loads. When the planner realizes that the alternative to this method is laborious number crunching using the Joint Munitions Effectiveness Manuals (at least 30 minutes per target line/aircraft combination) the advantages of the SON will be obvious.

Annex D

FIGHTER/DRONE FORCE SIZING

Annex D describes the mathematics behind the analytical formulas used when calculating the Planning Force. The annex is divided into two major sections deriving formulas for fighter aircraft and expendable drones.

FIGHTER SIZING FORMULA DERIVATION

This discussion starts with definitions of terms, derives the fighter sizing formula, presents sample comparisons, and extends the derivation to the actual Planning Force formula.

Definitions:
- BSR = blue sortie rate (per day)
- D = number of days considered
- BA = blue attrition
- S = number of sorties
- N = number of aircraft

Assumptions:
- Attrition occurs after ordnance delivery
- BSR = 3.0 sorties per day
- D = 7 days

Derivation: number of sorties (S) = number of aircraft (N) flown at given sortie rates for specified duration, accounting for attrition

or

	Day	Launch
S = N +	1	1
N(less 1st launch attrition) +	1	2
N(less 1st & 2nd launch attrition) +	1	3
N(less 1st, 2nd, & 3rd launch attrition) +	2	1
.	.	.
.	.	.
.	.	.
N(less attrition for first 20 launches)	7	3

Attrition is considered by calculating aircraft probability of survival.

$(1-BA)$ = probability of survival for an aircraft flying 1 mission
$(1-BA)^n$ = probability of survival for an aircraft flying n missions

Remember "D" equals 7 days and "BSR" equals 3.0. Therefore, the total number of missions over the period "D" is (D)(BSR) (21 in this example).

Substituting

$$S = N + N(1-BA)^{1} + N(1-BA)^{2} + N(1-BA)^{3} + . . . + N(1-BA)^{(D)(BSR)-1}$$

Note: The last term is raised to the "(D)(BSR)-1" power since the aircraft starting the last launch period are affected by the preceding launches. At this point it doesn't matter how many aircraft survive the last launch.

Written another way,

$$S = N + \sum_{n=1}^{(D)(BSR)-1} N(1-BA)^{n} = \sum_{n=0}^{(D)(BSR)-1} N(1-BA)^{n} = \sum_{n=1}^{(D)(BSR)} N(1-BA)^{n-1}$$

This works because $(1-BA)^{0} = 1$.

Now,

$$S = \sum_{n=1}^{(D)(BSR)} N(1-BA)^{n-1}$$ is a finite geometric progression.

$$\boxed{\begin{array}{c} a_n = a_1 r^{n-1} \\ \text{then} \\ \sum_{n=1}^{M} a_n = a_1 \dfrac{1-r^{M}}{1-r} \end{array}}$$ (2:92)

If

$M=(D)(BSR)$, $a_1=N$, and $r=(1-BA)$

then,

$$a_n = N(1-BA)^{n-1}$$

and

$$S = \sum_{n=1}^{(D)(BSR)} N(1-BA)^{n-1} = N \frac{1-(1-BA)^{(D)(BSR)}}{1-(1-BA)}$$

$$S = N \frac{1-(1-BA)^{(D)(BSR)}}{BA}$$

In this case $0<BA<1$ or messy things happen.

$$\boxed{S = N \frac{1-(1-BA)^{(D)(BSR)}}{BA}}$$

solves for number of sorties S

This can be rearranged

$$\boxed{N = S \frac{BA}{1-(1-BA)^{(D)(BSR)}}}$$

solves for number of aircraft N

SAMPLE SORTIE CALCULATION

An example might be helpful. Table D-1 shows a spreadsheet with different approaches to calculating sortie availability. First, the number of sorties is calculated manually, accounting for attrition on a launch-by-launch basis. Next, the sizing formula is applied using an average attrition rate (the method used in previous Planning Force calculations). Only the result is shown since the spreadsheet calculated everything in that location. Note that average attrition overstates sortie capability (e.g. 1649.5 sorties versus 1513.7). Finally, the sizing formula is used on a day-by-day basis. In this case, the sizing formula is used repeatedly for the period of one day. The answer is identical to the manual calculation (i.e. 1513.7). Periods longer than one day can be calculated if the attrition doesn't change. In this example day 6 and day 7 could be combined into a single calculation.

GIVEN: 1. 100 AIRCRAFT START (N)
2. 3.0 SORTIE RATE PER DAY (BSR)
3. 7-DAY CAMPAIGN (D)
4. FRACTIONAL AIRCRAFT CARRIED FORWARD

ATTRITION:	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7	AVERAGE (BA)
	.05	.04	.03	.02	.015	.01	.01	.025

MANUAL CALCULATION						FORMULA[1] **AVG ATTRT**	FORMULA[2] **DAILY ATTRT**
DAY	LAUNCH	ATTRT RATE	START	ATTRT	RTB	SORTIES	SORTIES
1	1	.05	100.00	5.00	95.00	1649.52	285.25
	2	.05	95.00	4.75	90.25		
	3	.05	90.25	4.51	85.74		
2	1	.04	85.74	3.43	82.31		247.06
	2	.04	82.31	3.29	79.02		
	3	.04	79.02	3.16	75.86		
3	1	.03	75.86	2.28	73.58		220.81
	2	.03	73.58	2.21	71.37		
	3	.03	71.37	2.14	69.23		
4	1	.02	69.23	1.38	67.85		203.57
	2	.02	67.85	1.36	66.49		
	3	.02	66.49	1.33	65.16		
5	1	.015	65.16	.98	64.18		192.56
	2	.015	64.18	.96	63.22		
	3	.015	63.22	.95	62.27		
6	1	.01	62.27	.62	61.65		184.95
	2	.01	61.65	.62	61.03		
	3	.01	61.03	.61	60.42		
7	1	.01	60.42	.60	59.82		179.46
	2	.01	59.82	.60	59.22		
	3	.01	59.22	.59	58.63		
			-------				-------
	TOTAL SORTIES		**1513.7**			**1649.5**	**1513.7**

Table D-1. Spreadsheet Comparison of Fighter Sizing Calculations

Since the spreadsheet calculations are not shown, the remainder of this section describes the calculations and compares the results.

<u>Calculation of Average Attrition</u>

The 1649.52 sorties shown under the "AVG ATTRT" heading were calculated using attrition averaged over the entire 7-day period. This method simplifies the calculations because the sizing formula only needs to be used once over the entire period. This is a big consideration if doing the calculations by hand. Average attrition is calculated as follows:

$$BA\ (7\text{-day average}) = \frac{.05 + .04 + .03 + .02 + .015 + .01 + .01}{7}$$

$$BA\ (7\text{-day average}) = \mathbf{0.025}$$

Sizing Formula Using Average Attrition

The values for the variables can be substituted into the sizing formula as follows:

Formula[1] $$S = (100) \times \frac{1-(1-.025)^{(7)(3)}}{.025}$$

$$S = \underline{1649.5}$$

Sizing Formula Calculated Day-by-Day

The right-most column of the spreadsheet calculates sorties on a day-by-day basis. This method is quicker than calculating sorties on a launch-by launch basis. The only tricky part is that the number of aircraft (N) starting the next period must be adjusted to reflect attrition during previous periods. This is the method used in current Planning Force spreadsheets. The first two calculations are shown. The remaining five calculations are performed in the same manner.

Formula[2] Day 1

$$S_1 = (100) \times \frac{1-(1-.05)^{(1)(3)}}{.05}$$

$$S_1 = \underline{285.25}$$

Before calculating the sorties on Day 2, the number of aircraft surviving Day 1 are required. This is calculated as follows:

$$N_2 = N_1\ (1-BA_1)^{(D)(BSR)} = (100)(1-.05)^{(1)(3)} = 85.74$$

With this result, Day 2 sorties can be found as follows:

$$S_2 = (85.74) \times \frac{1-(1-.04)^{(1)(3)}}{.04} = \underline{247.06}$$

This section has derived an analytical equation for finding sortie availability from a given number of aircraft (N) flown at a set sortie rate (BSR) for a given period of time (D) and experiencing losses at a set rate (BA). A comparison of different methods showed that the most rigorous approach of calculating sorties launch-by-launch could be exactly duplicated with the analytical formula. Also, the inaccuracies induced by using the simplifying assumption of average attrition were shown. The final portion of the section applies the sizing formula to Planning Force calculations.

Analytical Formula for Planning Force Requirements

The previous example showed how to calculate the number of sorties available for a given number of aircraft (N). The Planning Force has the opposite problem in that a number of aircraft (N) must be calculated given a required number of sorties to be flown. This section explains how to calculate sortie requirements and then how to calculate the number of aircraft required to provide them.

While Annex G contains a comprehensive example of fighter force sizing, it is useful to show the origin of the formula. The missing information at this point is the number of sorties required. This is determined by deciding upon the number of targets to be destroyed and applying two planning factors to determine sortie requirements. Those planning factors are expected kills per sortie (EKS) and partial sortie effectiveness (PSE).

Expected kills per sortie were explained in Annex C. In general terms, EKS predicts the effectiveness of an aircraft/weapon/target combination for an "average" sortie. Theoretically, the number of sorties required could be found by simply dividing the number of targets by EKS. However, EKS considers the time from target acquisition to weapon impact and does *not* consider difficulties in reaching the target. This is considered by PSEs.

Partial sortie effectiveness accounts for mission degradations short of aircraft attrition which prevent effective engagement of targets. These factors vary by target and aircraft types. These factors are always less than 1.00 and expand the number of sorties required to destroy a set of targets. With this final piece of information, the Planning Force sizing formula can be described.

The number of aircraft required to destroy a set of targets can be calculated as follows:

$$N = \frac{(TGTS)}{(EKS)(PSE)} \times \frac{BA}{1 - (1-BA)^{(BSR)(D)}}$$

where N = number of aircraft required

TGTS = number of AFPG III sub-targets to be destroyed (Annex G describes how this number is adjusted downward)

EKS = expected kills per sortie from the SON (Annex C)

PSE = partial sortie effectiveness (AF/XOXFW, MAA)

BA = blue attrition (WMP-5)

BSR = blue sortie rate (WMP-5)

D = length of period (AFPG III) consistent with BSR

This section has shown the origin of the fighter sizing formula. Although the underlying assumptions are quite different, the next section shows the drone sizing formula to be quite similar to the one for fighters.

DRONE SIZING FORMULA DERIVATION

This section defines terms, lists assumptions, derives the drone sizing formula, and presents some sample calculations.

Definitions:

RA = Red Attrition
D = number of days
S = number of targets
L = number of launches per day
BA = probability of blue drone attrition prior to engagement
N = number of drones needed to suppress S targets
PSE = partial sortie effectiveness
(1-BA) = probability of drone survival to target
(PSE)(1-BA) = probability of engagement

Assumptions: A certain percentage of a target base is killed by drone attacks while the remaining targets are disabled for a required period but regenerate for the next day.

D = 7 days

Drone attrition occurs <u>before</u> striking target.

Derivation:

On day 1/launch 1, $\frac{S}{(PSE)(1-BA)}$ drones are needed to address S targets.

At the end of attack there will be S(1-RA) targets remaining or

$S(1-RA)^{(D)(L)}$ after (D)(L) attacks.

Therefore,

$$N = \frac{S}{(PSE)(1-BA)} + \frac{S(1-RA)^{1}}{(PSE)(1-BA)} + \ldots + \frac{S(1-RA)^{(D)(L)-1}}{(PSE)(1-BA)}$$

Note: The last term is raised to the "(D)(L)-1" power because targets in the last launch period are affected by the preceding launches. At this point it doesn't matter how many targets remain after the last attack.

Written another way,

$$N = \frac{S}{(PSE)(1-BA)} [\ 1 + (1-RA)^{1} + \ldots + (1-RA)^{(D)(L)-1}\ ]$$

$$N = \frac{S}{(PSE)(1-BA)} \left[1 + \sum_{n=1}^{(D)(L)-1} (1-RA)^{n} \right]$$

or

$$N = \frac{S}{(PSE)(1-BA)} \sum_{n=0}^{(D)(L)-1} (1-RA)^{n} = \frac{S}{(PSE)(1-BA)} \sum_{n=1}^{(D)(L)} (1-RA)^{n-1}$$

Now,

$$N = \sum_{n=1}^{(D)(L)} \frac{S}{(PSE)(1-BA)} \times (1-RA)^{n-1}$$ is a finite geometric progression.

****
$$a_n = a_1 r^{n-1}$$ (2:92)

then

$$\sum_{n=1}^{M} a_n = a_1 \frac{1-r^M}{1-r}$$
****

If $M = (D)(L)$, $a_1 = \frac{S}{(PSE)(1-BA)}$, and $r = (1-RA)$

then,

$$a_n = \frac{S}{(PSE)(1-BA)} \times (1-RA)^{n-1}$$

and

$$N = \sum_{n=1}^{(D)(L)} \frac{S}{(PSE)(1-BA)} \times (1-RA)^{n-1} = \frac{S}{(PSE)(1-BA)} \times \frac{1-(1-RA)^{(D)(L)}}{1-(1-RA)}$$

****
$$\boxed{N = \frac{S}{(PSE)(1-BA)} \times \frac{1-(1-RA)^{(D)(L)}}{RA}}$$
****

An example using this formula might be helpful. A manual, day-by-day approach is calculated and compared to the sizing formula result. The results are shown in Table D-2.

GIVEN:
1. 100 TARGETS TO SUPPRESS/DESTROY (S)
2. 1 LAUNCH PER DAY IS SUFFICIENT (L)
3. 7-DAY CAMPAIGN (D)
4. FRACTIONAL REQUIREMENTS CARRIED FORWARD
5. SOME TARGETS ARE DESTROYED, OTHERS DISABLED
6. RED ATTRITION = .2 (RA)
7. DRONE ATTRITION BEFORE ENGAGING = .3 (BA)
8. PSE = 1.0

MANUAL EXAMPLE

DAY	START TGTS	DRONE ATTRT RATE	DRONE REQ	TGT ATTRT	END TGTS
1	100.00	.3	142.86	20.00	80.00
2	80.00	.3	114.29	16.00	64.00
3	64.00	.3	91.43	12.80	51.20
4	51.20	.3	73.14	10.24	40.96
5	40.96	.3	58.51	8.19	32.77
6	32.77	.3	46.81	6.56	26.21
7	26.21	.3	37.45	5.24	20.97
		TOTAL	**564.49**		

SIZING FORMULA:

$$N = \frac{100}{(1)(1-.3)} \times \frac{1-(1-.2)^{(7)(1)}}{.2}$$

$$= \underline{\mathbf{564.49}}$$

Table D-2. Spreadsheet Comparison of Drone Sizing Calculations

This section has described the derivation of a drone sizing formula and concluded with an example showing identical results for manual versus formula calculations.

Annex E

SENSITIVITY ANALYSIS

The mathematical formulations involved in the Planning Force may have significant sensitivities to the various input variables. This becomes of concern when the confidence level of the input figures is low. Figures E-1 through E-6 depict the sensitivities of Planning Force variables.

The sensitivity analysis is performed on the tactical fighter sizing equation derived in Annex D. For easy reference, it is repeated here.

$$N = \frac{(TGTS)}{(EKS)(PSE)} \times \frac{BA}{1 - (1-BA)^{(BSR)(D)}}$$

where N = number of aircraft required

- TGTS = number of AFPG III sub-targets to be destroyed (Annex G describes how this number is adjusted downward)
- EKS = expected kills per sortie from the SON (Annex C)
- PSE = partial sortie effectiveness (AF/XOXFW, MAA)
- BA = blue attrition (WMP-5)
- BSR = blue sortie rate (WMP-5)
- D = length of period (AFPG III) consistent with BSR

This annex uses the following base case.

TARGETS = 200
PSE = 0.5
EKS = 5
BA = 0.04
D = 7
BSR = 2.5

the ranges for individual variables are indicated on each figure.

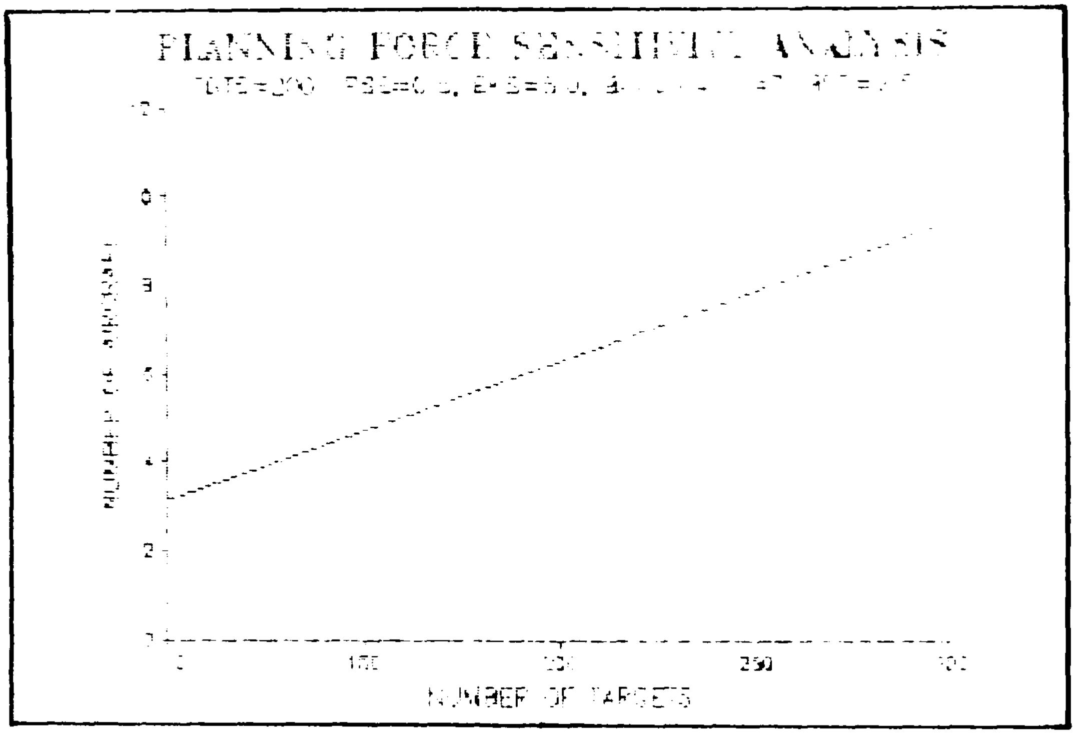

Figure E-1. Sensitivity to Number of Targets (N)

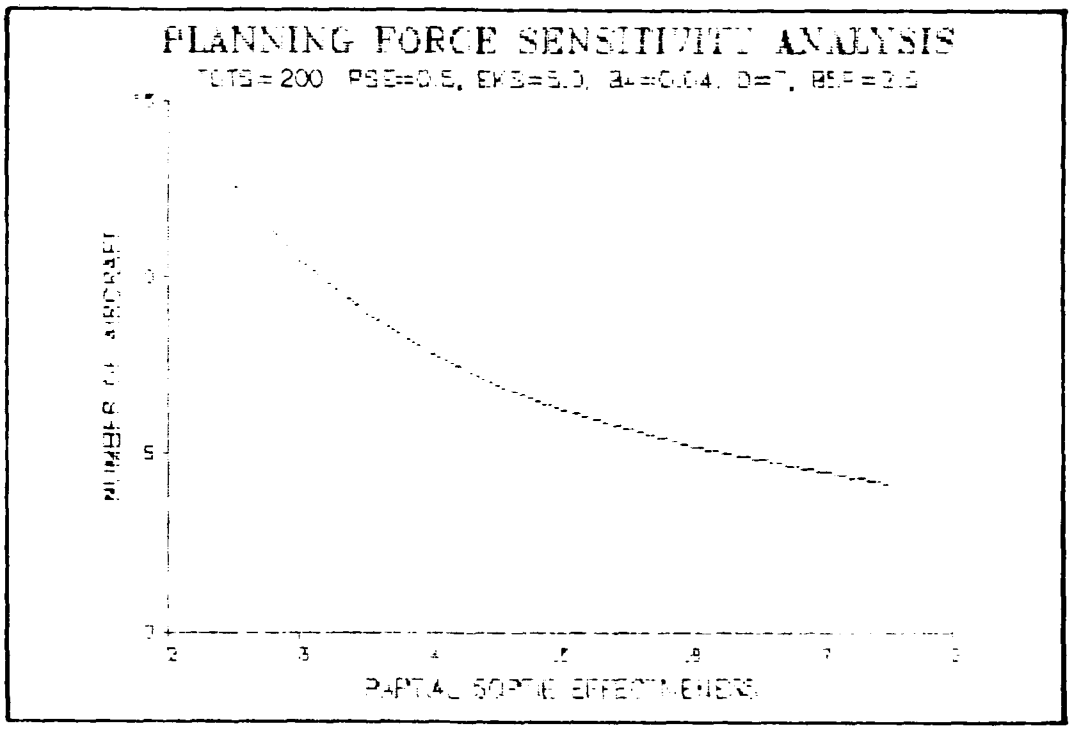

Figure E-2. Sensitivity to Partial Sortie Effectiveness (PSE)

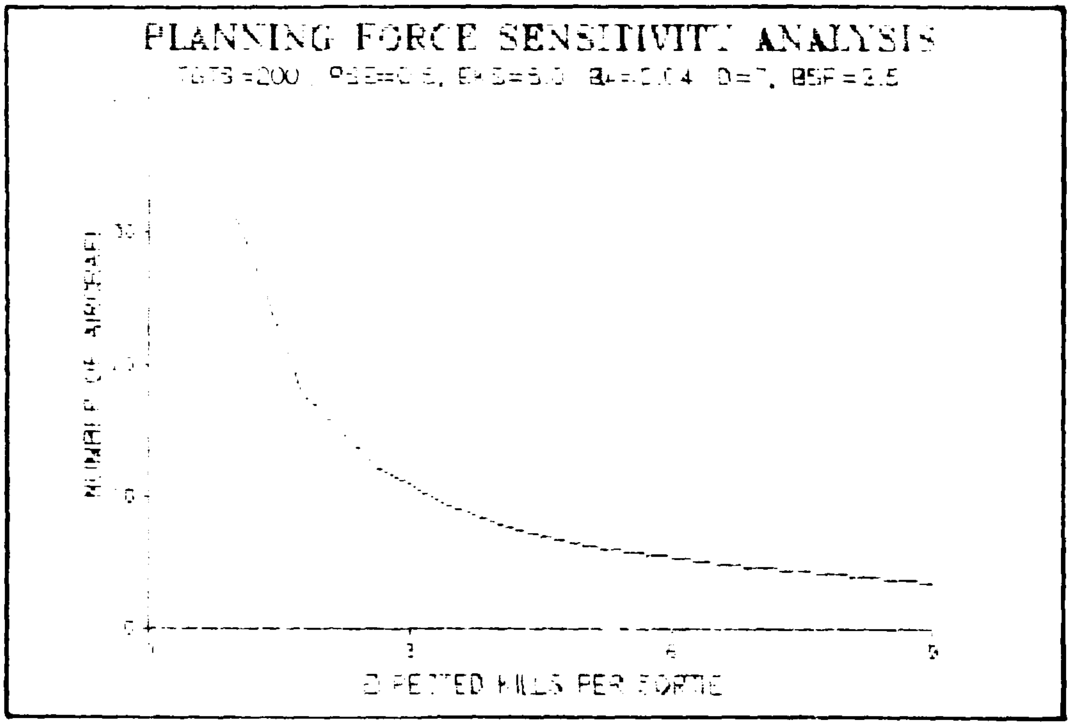

Figure E-3. Sensitivity to Expected Kills Per Sortie (EKS)

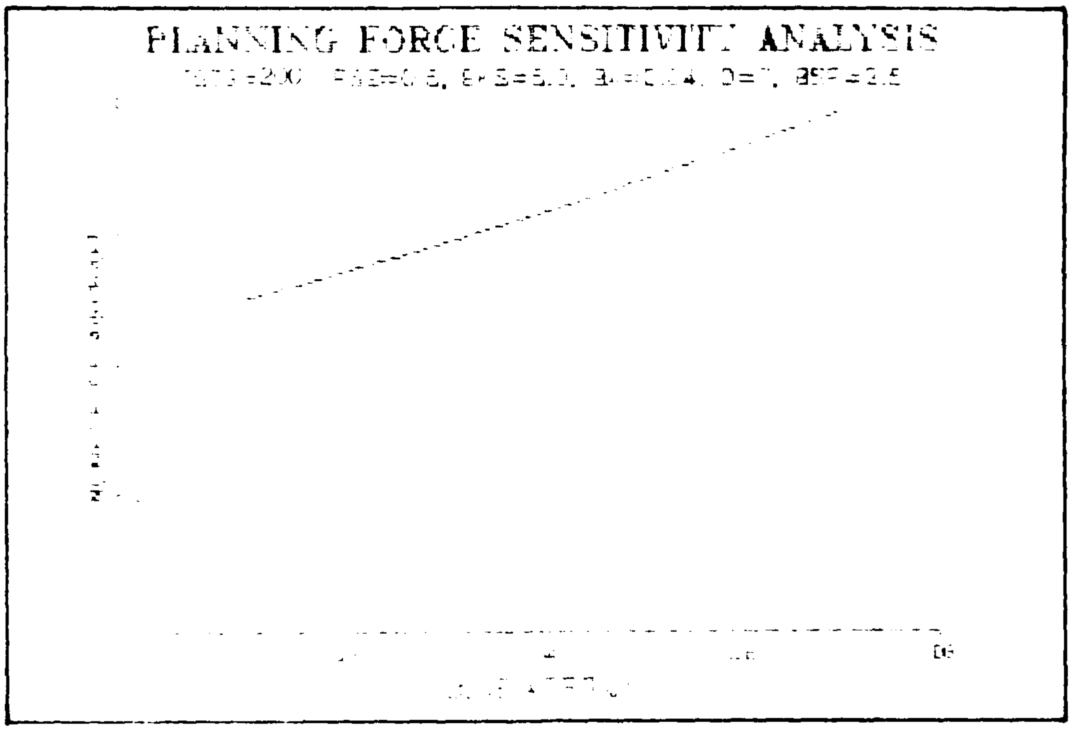

Figure E-4. Sensitivity to Blue Attrition (BA)

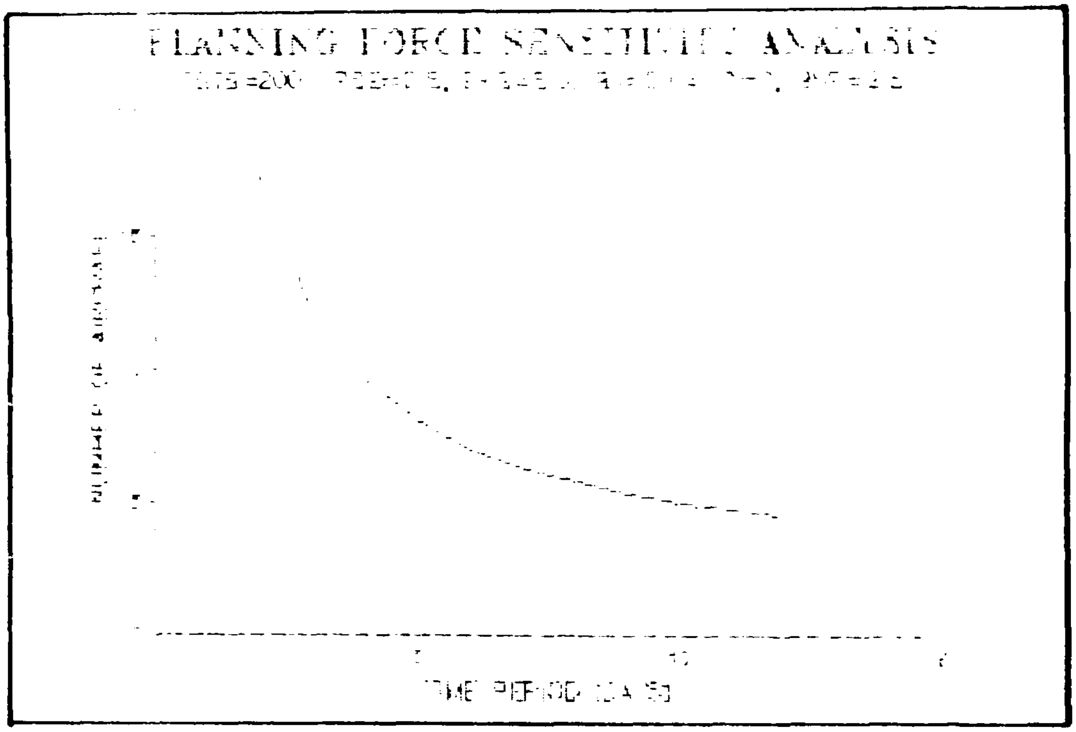

Figure E-5. Sensitivity to Time Period (D)

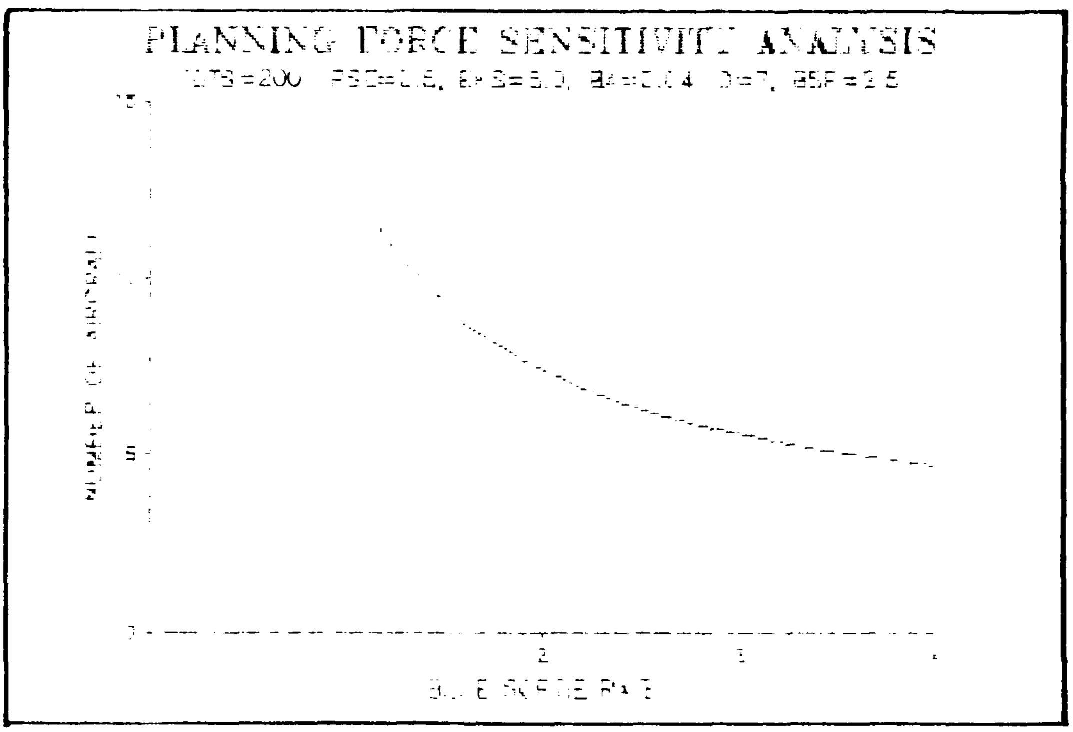

Figure E-6. Sensitivity to Blue Sortie Rate (BSR)

This annex will conclude with brief discussions of sizing formula sensitivities. Figure E-1 shows a linear relationship between targets and number of aircraft. As the number of targets increase, the number of required aircraft increases proportionally. Figure E-2 depicts an inverse relationship between partial sortie effectiveness and number of aircraft required. While there is a substantial increase in aircraft required with very low PSEs, the relationship is almost linear in the mid-range. Figure E-3 indicates a hyperbolic relationship between expected kills per sortie and aircraft required. The formula is quite sensitive to very low EKS values. Figure E-4 suggests an almost linear relationship between attrition rates and required aircraft. This could be expected to continue until very high attrition rates are encountered. Similar to EKS, Figure E-5 highlights a strong inverse relationship between time period and aircraft required. As the time available to destroy the targets decreases, the aircraft requirement increases dramatically. Figure E-6 verifies a similar relationship between blue sortie rate and aircraft required.

The results discussed here are of interest for calculating Planning Force requirements, as well as for real-life operations. The ability to fly and fight will be adversely affected by decreases in expected kills per sortie (kill effectiveness), time urgency (length of time available), and ability to generate sorties for an extended period of time (sortie rate).

Annex F

AIRCRAFT REROLE

1. This annex introduces the concept of aircraft rerole. A sample problem with rerole is described in Annex G.

2. Under certain circumstances, it may be possible to use a number of aircraft sized against one mission area in a different mission area. For example, a large number of F-16 aircraft might be needed for counter air missions during the first few days of a conflict. However, after air superiority is established, fewer aircraft would be required to maintain that superiority. The excess aircraft could (and would) be used elsewhere--namely in close air support and air interdiction missions. This is one reason that the Air Force has purchased multi-mission F-16s--to employ them where they are needed most, with the capability of switching missions.

3. Before considering aircraft rerole, the concepts of tactical missions and phase lengths must be understood. Planning Force tactical missions are counter air (to include offensive counter air [OCA]; defensive counter air [DCA]; command, control, and communications countermeasures [C3CM]; and suppression of enemy air defenses [SEAD]), close air support (CAS), and air interdiction (AI). The electronic combat (EC) missions of SEAD and C3CM are included in counter air for convenience of calculation as SEAD is also a counter air mission. In order to place priority of one mission over another for a specific period of time, the Planning Force divides the "war" into two phases. Phase I consists of the first few days of the conflict and varies in length depending on the tactical mission. Phase II is the remaining time until the "end" of the war. Priority missions have a short Phase I to dispose of priority targets quickly. Counter air is usually Phase I-intensive to achieve air superiority, while CAS and AI are usually Phase II-intensive. In addition, CAS and AI have more days to accomplish Phase I objectives.

4. There are two possible cases in which aircraft rerole can occur. These cases are referred to as Phase I-Phase II rerole and Phase I-Phase I rerole. For illustrations purposes, assume Phase I for counter air lasts 3 days, while Phase I for close air support lasts 7 days. Table F-1 shows rerole relationships.

a. Phase I-Phase II Rerole. Suppose that counter air F-16 aircraft are also compatible with air-to-ground operations and are suitable for reroling if the option arises. Excess counter air F-16s not needed for Phase II counter

	Day 1	2	3	4	5	6	7	8 ...	
CA Requirements*	60	60	60	10	10	10	10	10	
Idle				50	50	50	50	50	
CAS Requirements*									
No Rerole	60	60	60	60	60	60	60	80	Peak
CA+CAS Total	120	120	120	120#	120	120	120	140	140
PhI-PhII Rerole	60	60	60	60	60	60	60	30	
Rerole Aircraft								50	
CA+CAS Total	120	120	120	120	120	120	120	90	120
PhI-PhI Rerole	30~	30	30	30	30	30	30	30	
Rerole Aircraft				50	50	50	50	50	
CA+CAS Total	90	90	90	90	90	90	90	90	90

* No attrition assumed for ease of presentation

\# Includes idle aircraft

~ In this case, only 30 aircraft start Phase I (versus a requirement of 60), because some CAS targets are deferred to Days 4-7 when rerole aircraft are available; 80 aircraft during Days 4-7 destroy the deferred targets and the original targets. By deferring the CAS targets, the total aircraft requirement drops by 30 (120 - 90 = 30)

Table F-1. Phase I-Phase II and Phase I-Phase I Rerole

air can be "reroled" into Phase II of close air support. The Phase I requirement remains the same for both counter air and close air support. However, the Phase II CAS requirement will be decreased by the number of rerole aircraft. Phase II counter air requirements remain the same.

b. Phase I-Phase I Rerole. The Phase I-Phase II rerole example was unrealistic in one respect. The counter air aircraft in excess of Phase II counter air requirements (the "rerole" aircraft) were idle from Day 4 until Day 8 (i.e., the start of CAS Phase II). In real life, these aircraft would be used in some capacity. It seems logical to apply the rerole aircraft immediately to Phase I of close air support to further reduce Planning Force requirements.

5. Phase I-Phase I rerole adds another element of risk to the force structure planning requirements. In an extreme case, the analytical sizing formulas might result in the last friendly aircraft being destroyed on the sortie that destroys the last enemy target. Mathematically this is okay; realistically, it is completely unacceptable. The Planning Force should double check end strengths to ensure acceptable reserves will be available at the "end" of the

war. Minimum Risk Force planners might consider Phase I-Phase I rerole as inconsistent with "no risk."

6. Phase I-Phase II and Phase I-Phase I rerole offer realistic ways of reducing MRF and PF requirements. Rerole permits the mathematics to capture the real world more effectively. Care must be taken, particularly by MRF planners, not to stretch this tool too far. A quantitative rerole example is presented in Annex G.

Annex G

FIGHTER SIZING EXAMPLE WITH REROLE

1. This annex shows how to apply the analytical formula derived in Annex D. A similar approach may be useful for other than tactical forces. This annex approaches a typical sizing problem by first laying out assumptions, reviewing the sizing formula, describing a basic sizing problem without rerole, then concluding with examples of Phase I-Phase II and Phase I-Phase I rerole.

2. This example uses arithmetically averaged attrition rather than applying attrition on a day-by-day basis. This was a simplifying assumption applied when the Planning Force was calculated by hand and is quite adequate for showing how the formula works.

3. The following formula is used to calculate required force sizes:

$$\frac{(\text{TARGETS})(\text{BS})(\text{BG})(\text{PHASE OBJ})}{(\text{EKS})(\text{PSE})} \times \frac{\text{BA}}{1 - (1-\text{BA})^{(\text{BSR})(\text{D})}} = \text{N}$$

where TARGETS is the number of AFPG III target elements
BS is Blue Share or % of targets assigned to USAF
BG is Blue Goal or % of USAF targets which must be destroyed to be militarily effective
PHASE OBJ is the % split of targets between Phase I and Phase II
EKS is expected kills per sortie (sometimes called Blue Kills)
PSE is Partial Sortie Effectiveness
BA is Blue Attrition
BSR is Blue Sortie Rate
D is the time period (consistent with BSR)
N is the number of aircraft required to accomplish the objective

4. <u>Basic Sizing Example</u>

a. This basic example shows how to use the sizing formula. Aircraft rerole is considered in Section 6 of this annex. Assume that a particular target line in the <u>Air Force Planning Guide, Vol III, Threat</u> (AFPG III) describes a target of armored personnel carriers (APCs) with a target quantity of 1500 and number of sub-targets of 1. This results in 1500 target elements (1500 x 1 = 1500). Say that the Blue Share is 1200 target elements (80%). Allied forces and sister services would be responsible for the other 300. Next, assume that the Blue Goal is 80% of the 1200 APCs since that number will render the enemy militarily ineffective. Therefore, a total of 960 APCs must be destroyed during the "war" (Phase 1 and Phase 2 of close air support). Now, assume priorities are such that 50% of the APCs must be destroyed in Phase I and the remaining 50% must be destroyed in Phase II. This means 480 targets must be destroyed in Phase I and the remaining 480 targets destroyed in Phase II. AFPG III consolidates much of this information, so the specific breakout described in this hypothetical example will not be inherently obvious. The AFPG III target line will contain a descriptor indicating Armored Personnel Carriers with a quantity of 1500 and sub-targets of 1. The Phase I Objective would be reported as 32% (BS x BG x Phase I Percentage or 0.8 x 0.8 x 0.5 = 0.32); the Phase II Objective is also 32%. AFPG III has already calculated the product of (BS)(BG)(Phase Percentage).

b. With 480 APCs to destroy in both Phases I and II, the next step is to determine the EKS and PSE against this target. As a notional example, suppose that F-16 aircraft with Mk-20 Rockeye are chosen for this close air support (CAS) target. First, assume CAS has a Phase I length of 7 days. Next, assume that an F-16 can carry 6 Mk-20s. Assume that a quick reference to the Nonnuclear Consumables Annual Analysis (NCAA) shows an expected kills per sortie (EKS) of 2.4 targets destroyed for six Mk-20 canisters dropped in one pass against a column of APCs in optimum weather conditions. A similar result would be obtained if the P_k for two Mk-20s against a single APC was 0.8 APCs. The 0.8 should be multiplied by three available passes for the EKS of 2.4 APCs.

c. Next, assume a PSE table is available which specifies a partial sortie effectiveness of 0.9 for Phase I missions and 0.85 for Phase II missions. This may be due to difficulties in integrating with the Tactical Air Control System, overall reliability of the F-16 weapons release system, or other factors which are required to place the aircraft in a position from which to deliver ordnance. Now the number of sorties required to destroy the targets can be calculated for each phase.

d. The number of sorties required is given by the first portion of the sizing formula:

$$\frac{(\text{Targets}) \times (\text{BS}) \times (\text{BG}) \times (\text{Phase Obj})}{(\text{BK}) \times (\text{PSE})} = \text{Sorties Required}$$

The phase sortie requirements are as follows:

Phase I

(1500 x 0.8 x 0.8 x 0.5) / (2.4 x 0.9) = 222.2 sorties

Phase II

(1500 x 0.8 x 0.8 x 0.5) / (2.4 x 0.85) = 235.3 sorties

e. The next step is to determine the sortie rate and attrition. Assume the following values for sortie rates and attrition.

F-16 Sortie Rates		F-16 Attrition	
Days 1-7	Days 8-	Days 1-7	Days 8-
2.5	2.0	0.04	0.02

f. With this information, force sizing can now be accomplished. Recall the force sizing formula:

$$S \times \frac{BA}{1 - (1-BA)^{(BSR)(D)}} = N$$

Phase I F-16 Aircraft Required

$$222.2 \times (0.04 / (1 - (1-0.04)^{(2.5)(7)})) = \underline{17.4 \text{ F-16 aircraft}}$$

Phase II F-16 Aircraft Required

$$235.3 \times (0.02 / (1 - (1-0.02)^{(2.0)(53)})) = \underline{5.3 \text{ F-16 aircraft}}$$

Notice that the requirement for Phase II is lower than Phase I. The lower attrition and longer phase length offset the lower sortie rate and PSE.

g. The "Planning Force" is the number of aircraft required to start the "war" and satisfy both phase requirements. As noted above, Phase I requires 17.4 F-16s while Phase II requires 5.3 aircraft. Regardless of which phase has the larger requirement, the attrition in Phase I must be considered. This is calculated by finding the probability of survival for a single aircraft and then calculating the expected number of aircraft remaining at the end of Phase I. The probability of survival of a single F-16 throughout Phase I in this example is found using:

$$(1 - BA)^{(BSR)(D)}$$

or

$$(1-0.04)^{(2.5)(7)} = 0.489$$

The expected number of aircraft to remain at the end of Phase I will be:

$$(17.4)(0.489) = 8.5 \text{ aircraft}$$

Note that this number is larger than the Phase II requirement of 5.3 which means the "Planning Force" is 17.4 aircraft (the Phase I requirement) since this number is sufficient to accomplish both phase objectives. If the number remaining had been smaller than the Phase II requirement, the number of aircraft attrited in Phase I would have to be determined. This is:

$$17.4 - 8.5 = 8.9 \text{ aircraft}$$

The "Planning Force" would be found by adding Phase I attrition (8.9 aircraft) to the Phase II requirement (in this case, 5.3 aircraft). This would ensure that aircraft could be flown in Phase I with enough residual to meet Phase II requirements. In summary, the force structure necessary to fly a particular mission is the Phase I requirement or the Phase II requirement plus Phase I attrition, whichever is greater.

5. Troublesome Points

a. There may well be some questions concerning the use of fractional aircraft. This is largely a matter of which level of aggregation is chosen for the analysis. It is logical that F-16 aircraft could perform CAS by attacking APCs as well as other targets, such as tanks, personnel, command posts, etc. Consequently, a single aircraft could theoretically exhaust one target type and move on to the next, resulting in fractional aircraft usage for a particular target type. At some point, rounding must be accomplished to deal with "whole" systems, but this can be done when totaling aircraft required for CAS rather than for a single target type. This is a case in which the Minimum Risk Forces could be more conservative. The conservative approach would be to round up the aircraft requirement for each target type, rather than waiting and rounding up for a total mission area (i.e. CAS). The result would be a larger total force.

b. Another question might be the validity of Phase I attrition if more aircraft start the Phase than the original requirement. The larger number of aircraft would be subject to more attrition, leaving too few aircraft to start Phase II. This can be simplified by assuming that only the Phase I requirement flies in Phase I with the remainder held in reserve. This probably would not happen in war, but it is a warranted simplifying assumption.

6. Phase I-Phase II Rerole. This hypothetical example will continue by illustrating the first rerole case which will be referred to as Phase I - Phase II rerole. Using the CAS example discussed previously, assume that F-16 aircraft in the counter air (CA) role are compatible with air-to-ground

operations and are suitable for reroling if the option arises. Also assume that the Phase I CA requirement is 14 F-16s, Phase I attrition is 6 aircraft, and the Phase II requirement is 4 aircraft. In this situation, 8 aircraft remain at the end of CA Phase I with a Phase II requirement of only 4 aircraft. This leaves an excess of 4 aircraft which could be used elsewhere. If these aircraft are applied to the CAS case discussed earlier, only 1.3 CAS aircraft would be required at the beginning of Phase II (5.3 - 4). This does not reduce the "Planning Force" in this case since the Phase I requirement is dominant. However, if the Phase II requirement dominated, Phase I-Phase II rerole would reduce the overall "Planning Force" requirement.

7. Phase I-Phase I Rerole. If 4 F-16 aircraft are idle from the end of CA Phase I (Day 3) until the beginning of CAS Phase II (Day 8), it seems logical that these aircraft could be applied immediately to Phase I of CAS and further reduce the "Planning Force." This process is referred to as Phase I- Phase I rerole.

a. Recall that the Phase I requirement for CAS is 17.4 aircraft over the period of 7 days. Also, 4 CA aircraft will be available for CAS starting on Day 4 and will be available for CAS for the remainder of the planning period. These aircraft can be used to offset some of the sorties the original 17.4 F-16 aircraft were intended to fly.

b. Several additional figures are required before proceeding with this example. The notional attrition for CAS Phase I is 0.04 averaged over the entire 7-day phase, but attrition figures for the first 3 days and the last 4 days are required to proceed. Assume that the attrition rate for Days 1-3 is 0.05 and 0.0325 for days 4-7. While these numbers are notional only, Planning Force attrition rates are drawn from the USAF War and Mobilization Plan, Volume 5 (WMP-5) (6:--).

c. Now further calculations can proceed. The number of sorties that could be flown by the reroled F-16 aircraft are required. This is found by use of the sizing formula.

$$S \times (BA / (1 - (1-BA)^{(BSR)(D)})) = N$$

This can be reorganized as follows:

$$N \times ((1 - (1-BA)^{(BSR)(D)}) / BA) = S$$

This version allows computation of the number of sorties available from a given number of aircraft. Substituting numbers into the formula:

$$(4) \text{ X } (1 - (1-0.0325)^{(2.5)(4)}) / 0.0325 = \underline{34.6 \text{ sorties}}$$

Notice that the attrition factor for Days 4-7 was used along with the reduced number of days (D) in which to accomplish the sorties. Recall that the original sortie requirement for CAS Phase I was 222.2. If the 4 CA F-16s are reroled into CAS, the Phase I CAS requirement would drop from 17.4 aircraft to something less. The number of sorties remaining to be accomplished must be determined as follows:

$$222.2 - 34.6 = \underline{187.6 \text{ sorties}}$$

The next step is to size a force over the entire 7-day phase which can accomplish 187.6 sorties. This is accomplished by applying the sizing formula.

$$(187.6) \times (0.04 / (1 - (1-0.04)^{(2.5)(7)})) = \underline{14.7 \text{ F-16s}}$$

Notice that the original attrition and phase length were used. The Phase I requirement for dedicated CAS aircraft has dropped from 17.4 to 14.7. This did not drop by the full number of CA rerole aircraft since the rerole aircraft fly their sorties over fewer days. To determine the "Planning Force," the attrition for both types of F-16s must be determined.

<u>CAS Phase I Aircraft Remaining</u>

<u>Dedicated CAS Aircraft</u>

$$14.7 \times (1-0.04)^{(2.5)(7)} = \underline{7.2 \text{ aircraft}}$$

<u>Rerole F-16 Aircraft</u>

$$4 \times (1-0.0325)^{(2.5)(4)} = \underline{2.9 \text{ aircraft}}$$

The total aircraft remaining at the end of Phase I is 10.1 (7.2 + 2.9 = 10.1). This is sufficient to accomplish CAS Phase II which requires 5.3 aircraft at the beginning of the phase. The total CAS "Planning Force" becomes 14.7 F-16s versus the no-rerole figure of 17.4 aircraft. This is a 16% reduction in the required force size.

d. If more CA F-16s had been available, even fewer aircraft would have been needed to begin Phase I of CAS. Carried to the extreme, there might be cases in which no requirement would exist because the entire requirement could be accomplished by rerole aircraft. This is inadvisable on several counts. The most compelling reason to NOT rerole the entire phase is the inherent delay in starting the sorties. No sorties could be accomplished until the end of the CA Phase I. The U.S. Army might have a few objections to no CAS for the first three days of the war. As a result, at least some CAS is required in the early days of Phase I.

e. Although arbitrary, a "50% rule" provides a "ceiling" or maximum for rerole sizing (or a "floor" for the force starting Phase I) in cases of excess rerole capability. This rule takes the number of Phase I requirements before rerole is considered and halves it. This becomes the minimum starting force. This force accomplishes some sorties on Days 1-3. A number of sorties remain to be completed on Days 4-7--more than if the original aircraft phase requirement was used from the outset of the phase. The number of sorties required for Days 4-7 is calculated and the number of rerole aircraft "accepted" is computed. The "50% rule" was not invoked in the preceding example. The "50% rule" is automatically considered in the spreadsheets described in Annex H. Also, the "ceiling" can be adjusted in the spreadsheet by the user.

f. When the "50% rule" is invoked, the discontinuity in averaged attrition rates becomes somewhat of a problem. This has been resolved by the AF/XOXFT spreadsheets which do not arithmetically average attrition and sortie rates.

8. <u>Conclusion</u>. Annex G has presented a step-by-step example of fighter force sizing. The factors were discussed, the sizing formula was applied, and the "Planning Force" requirement was determined. This basic example underlies most Minimum Risk/Planning Force calculations. Finally, reductions in force size through aircraft rerole were discussed.

Annex H

TACTICAL FIGHTER/ELECTRONIC COMBAT PLANNING FORCE SPREADSHEET ARCHITECTURE

1. Purpose

This annex explains the layout of Planning Force spreadsheets. This should assist Air Staff planners in making updates to future Planning Forces as well as MAJCOM planners in producing Minimum Risk Forces. Unclassified portions of the Korea spreadsheet with notional numbers have been reproduced here for purposes of explanation. The office of primary responsibility (OPR) for the spreadsheets is the Tactical Forces Division, Directorate of Plans (AF/XOXFT), Room 4A1070, Pentagon, Washington, D.C. 20330, Autovon 225-4709.

2. Application

The Korea spreadsheet described here is but one of a series of spreadsheets used to calculate the USAF Tactical Fighter Planning Force. There are similar spreadsheets for Europe (NATO), Southwest Asia (SWA/CENTAF), the Atlantic/Caribbean (CUBA/LANTCOM), the Socialist Republic of Vietnam (SRV/PAC VIETNAM), and the Soviet Far East Military District (FEMD/PAC SOVIET). The layout is identical in each case. Lines corresponding to targets have been adjusted so that each theater can use the same basic spreadsheet. For example, counter air always starts at line 6. Reasons for this layout will become more apparent as the spreadsheet is described.

3. Reasonable Assurance of Success

The numbers represented in the actual spreadsheets are intended to provide a "reasonable assurance of success." To produce Minimum Risk Forces, it is expected that MAJCOM planners would update various factors such as sortie rates, expected kills per sortie (EKS/BK), and Phase Objectives to provide a "virtual assurance of success." Such changes can be easily made on the spreadsheets. To prevent inadvertent erasure of critical formulas, those cells have been "protected." The only numbers that can be modified without advanced knowledge of SuperCalc 3 are those which were subject to change. See Section 16 of this annex for further details.

4. Equipment Requirements

The spreadsheets were designed for use on Z-150/IBM PC equipment with memory expansion boards supporting 640K of Random Access Memory (RAM). A printer would be very useful for output of data, preferably capable of condensed print due to the size of the spreadsheet. The INTEQ 8087 math coprocessor chip is optional, but cuts computation times by a factor of three.

5. Architecture Overview

The premise behind the spreadsheets was to make it easier to change the planning factors. Cell referencing is used extensively. Figure H-1 shows the general layout of the spreadsheet. Targets are summarized on the leftmost section. Columns for various aircraft extend across the spreadsheet to the right. Each aircraft type refers back to the target columns to determine how many targets must be destroyed. For a given aircraft, planning factors needed for various calculations are located at the bottom of the spreadsheet. These have been placed in the column in which they will be used. The middle rows of the spreadsheet contain summaries and rerole calculations. The cell reference system identifies the upper left and lower right corners of a region (i.e., for A4:F256, targets are described in a rectangular area starting with cell A4, extending down to row 256 and right to column F).

TARGETS	A-7+	A-10A	A-16	ATF	F-15	F-15E	F-16	F-111	F-4G	FOWW	DRONE
A4:	H4:	Q4:	Z4:	AI4:	AR4:	BA4:	BJ4:	BS4:	CB4:	CK4:	CT4:
F256	P256	Y256	AH256	AQ256	AZ256	BI256	BR256	CA256	CJ256	CS256	DB256

SUB-TOTALS BY MISSION AREAS ---
A258:DB282

AIRCRAFT SUMMARIES   WILD WEASEL SORTIE SUPPORT
A283:N321   P283:AB321

REROLE CALCULATIONS
A323.W359

THEATER SUMMARIES------------------
NO REROLE   PH1 REQ ONLY
A361:H378   J361:Q378

FULL REROLE   PH1 + PH2 REQ
A379:H396   J379:Q396

PLANNING FACTORS--
A399:DB427

Figure H-1. Spreadsheet Architecture

6. Targets

Figure H-2 shows the upper left corner of the spreadsheet. The first few rows are self explanatory. Columns A through F are drawn primarily from the Air Force Planning Guide, Vol III, Threat (AFPG III) (5:--). This is quite handy since AF/XOXFW generates AFPG III using electronic spreadsheets. The target descriptions and counts are lifted directly from the parent files. The XOXFT spreadsheet multiplies the sub-targets by the target quantity to determine the "TOTAL TARGETS" column. This is not computed in AFPG Vol III. The Phase Objectives are percentages of the target base that must be destroyed to accomplish military objectives. These are described in more detail in Annex G. The "TOTAL CONTRIB" column is calculated in the Planning Force spreadsheet. As will be seen, each aircraft can be given a percentage of the target base to destroy (TOTAL TARGETS times PHASE OBJ). These are totaled for each target line as a check that not more than 100% of the desired targets are "destroyed." There are times when the "TOTAL CONTRIB" or total contribution may be other than 100%. This situation arises when a part of the Air Force share of targets is assigned to some force other than tactical fighters. For instance, 10% of a particular target set might be destroyed by B-52Gs. This is done external to this spreadsheet; the "TOTAL CONTRIB" column should show 90%. Another example is when the planner wants to credit the inherent air-to-air capability of multi-role aircraft sized against air-to-ground missions. For instance, F-15E aircraft sized for air interdiction targets would also carry AIM-9Ls for self-protection. If these F-15Es destroyed 2% of the air-to-air target base in self-defense, the "TOTAL CONTRIB" column should read 98%. Two points are important here. First, the sum in the "TOTAL CONTRIB" column is adjusted downward by assigning smaller percentages of the Air Force Share to individual aircraft (discussed in the next section). Second, do not try to account for the air-to-air capability of F-15Es by sizing them in the

	A	B	C	D	E	F	G
1				TACTICAL FORCES FY 91-98 USAF PLANNING			
2	1/19/1987			OPR: HQ USAF/XOXFT, AV 225-4709			
3				HD2: D:\PACAF\PACKPF.98			
4	*** PACIFIC KOREA ***	Sub	Tgt	Total	PH 1	PH 2	
5		Tgts	Quant	Tgts	Obj(%)	Obj(%)	TOTAL
6	A. Counterair						CONTRIB
7	1. Airborne Vehicles						
8	a. Deep Attack (Day 1)						
9	(1) Air-to-Air	x	x	x	x%	x%	100
10	(2) Air-to-Ground	x	x	x	x%	x%	100
11	(3) Bombers	x	x	x	x%	x%	100
12	(4) Recce/EW	x	x	x	x%	x%	100
13	(5) Airlift (AN-2)	x	x	x	x%	x%	100

"x" indicates numerical entry removed due to classification

Figure H-2. Targets

air-to-air section. This would result in the original number of air-to-ground F-15Es plus additional F-15Es in the air-to-air section which, in effect, kill the same air-to-air targets already killed by the air-to-ground aircraft. Finally, some targets may be considered so critical as to require overlapping coverage. For instance, some suppression of enemy air defenses (SEAD) targets might be hit by both drones and Wild Weasels.

7. Aircraft Allocation/Force Sizing

Two examples are provided here to demonstrate the sizing of forces against air-to-air and air-to-ground targets. The first example shows the F-15 against the target base described in the previous example. Line numbers correspond directly with the target descriptions. Note in Figure H-3 that each aircraft has nine separate columns associated with it. The aircraft in question is identified at the top (line 4). The "% CONTRIB" column is the percentage of the targets (TOTAL TGTS times OBJ) which a particular aircraft is assigned to destroy. This is the aircraft "CONTRIBUTION" to the destruction of the target line. This number should not exceed 100% for a single aircraft/weapon system. The next column, "BK," contains the expected kills per target (EKS) or Blue Kills (BK) for a particular weapons load for that aircraft against the indicated target line. For Planning Force purposes, these numbers are drawn from weapons printouts supplied by AF/XOXFM, the Munitions Plans Division. See Annex C for a discussion of air-to-ground expected kills per sortie. Air-to-air EKS figures should consider the probability of engagement (P[engagement]) since PSE does not include this factor. P[engagement] factors are available from the Tactical Forces Division of Air Force Studies and Analysis (SAGF). The next two columns show the results of calculations to determine the number of targets an aircraft type must destroy in a particular phase. This is simply the product of TOTAL TGTS

	AR	AS	AT	AU	AV	AW	AX	AY	AZ
1									
2									
3									
4	F-15A/D ----------								
5	-	%	BK	--TARGETS--		--SORTIES--		--AIRCRAFT--	
6		CONTRIB		PH 1	PH 2	PH 1	PH 2	PH 1	PH 2
7									
8						ROW 403----------			
9		y	y	z	z	z	z	z	z
10		y	y	z	z	z	z	z	z
11		y	y	z	z	z	z	z	z
12		y	y	z	z	z	z	z	z
13		y	y	z	z	z	z	z	z

"y" indicates user inputs, "z" indicates calculated values

Figure H-3. Air-to-Air Sortie and Force Sizing times OBJ(%) times % CONTRIB for both phases. The next two columns show the number of sorties required to destroy the required targets. This is calculated by dividing the number of targets by the BK and then dividing by the Partial Sortie Effectiveness (PSE). Since BK is the number of expected kills per sortie, dividing by that factor determines the expected number of sorties to destroy the target base. This is adjusted by dividing by the PSE to account for various difficulties in reaching and attacking the target area. This factor is located at the bottom of the spreadsheet in the "Planning Factors" section. The "ROW 403" identifies the location of the required PSE for this set of target lines. The factors are located in the same column requiring the calculation, so the PSE required for cell AW9 is located in cell AW403. This makes replicating formulas much easier than might otherwise be the case. Finally, the number of aircraft required for both phases are calculated in the last two columns. A planning factor which accounts for phase length, sortie rates, and attrition is located at the bottom of the spreadsheet as with PSEs. To determine the number of aircraft required in cell AY9, the number of sorties in cell AW9 was divided by the planning factor calculated in cell AY403. Note that "ROW 403----" heading extends to the aircraft columns. There will be cases when a new row will be referenced for calculating the number of aircraft.

6. Replicating Formulas

An intermediate knowledge of SuperCalc 3 is assumed in this discussion. Typing in formulas for each cell would be very tedious to say the least. In the case where an aircraft is allocated against targets which it did previously strike, replication of formulas speeds the process. In the previous F-15 example, assume that a new target line 14 was added and the F-15 is to be allocated against the new target. Presumably, the new line has already been inserted with the appropriate target counts and phase objectives. The user would type in the "% CONTRIB" and "BK" which would probably be similar to adjacent lines. Then cells AU13 to AZ13 would be replicated starting at cell AU14. To replicate properly, some cell references should be adjusted for the new row and some should not. Fortunately, SuperCalc 3 (SC3) has an option for this. Using that option, SC3 asks which cells should be adjusted. For the target counts, all three cell references should be adjusted (TOTAL TGTS, OBJ(%), and % CONTRIB). For aircraft sorties, the PSE should <u>NOT</u> be adjusted while the reference to targets and BK should be. For aircraft numbers, the planning factor should <u>NOT</u> be adjusted while the cell reference to number of sorties should be. This may sound a bit esoteric, but the row numbers of the cell references give away which factors should be adjusted. For this example, anything with row numbers larger than 400 should NOT be adjusted while everything else should. The last item to discuss here is when a large number of replications is desired. It is suggested that replications be accomplished within similar target types. New target types (for instance moving from Deep Attack to Direct Support) will involve a change in row number for the planning factors. Replicating within a target subset is accomplished as described above. The questions of which cell to adjust need only be answered once in this case. If allocations against a different set of targets needs to be replicated, it is suggested that normal replication from another target grouping be accomplished against a single target line in the new grouping. The formulas can then be edited to reflect the row numbers in the prompts in the "SORTIES" and "AIRCRAFT" columns. Then that set of entries can be replicated throughout the remaining target lines in the new grouping. This really isn't as complicated as it sounds!

9. Air-to-Ground Force Sizing

The principles for sizing air-to-ground forces are identical to those for air-to-air. This example is included to convince the skeptical reader. Figure H-4a provides column headings for the F-16.

```
      :  BJ ::  BK :: BL ::  BM ::  BN ::  BO  ::  BP  ::  BQ  ::  BR  :
1
2
3
4      F-16A/D -------------------------------------------------------
5                  %     BK  --TARGETS--     --SORTIES--     --AIRCRAFT--
6            CONTRIB         PH 1   PH 2   PH 1     PH 2   PH 1     PH 2
```

Figure H-4a. F-16 Column Headings

Next, Figure H-4b shows several rows of interdiction targets extracted for this example. Specific target descriptions are not critical to this example. The only change here is that planning factors for PSEs and aircraft sizing are drawn from rows 414 and 410 respectively. Force sizing and replication of formulas are exactly as described in previous sections.

```
             :  BK :: BL ::  BM ::  BN ::  BO  ::  BP  ::  BQ  ::  BR  :
153                                  ROW 414-------- ROW 410--------
154               y     y     z      z      z       z       z       z
155               y     y     z      z      z       z       z       z
156               y     y     z      z      z       z       z       z
157               y     y     z      z      z       z       z       z
158               y     y     z      z      z       z       z       z
159               y     y     z      z      z       z       z       z

               "y" indicates user entry, "z" indicates calculated value
```

Figure H-4b. Air-to-Ground Sortie and Force Sizing

10. Sub-Totals

The next area for discussion is sub-totals. In some cases, it is convenient to break out targets destroyed, sorties, and aircraft required by mission area. Two levels of sub-totals are provided for this purpose. This section is also used to build subsequent summary tables. Only the row titles and the Korean target summary are shown here. In actuality, the summary rows extend across the breadth of the spreadsheet to cover each weapon system. See Figure H-5.

```
    :              A             :: B :: C ::  D  :
257 ################################################
258                                           Total
259                                           \Tgts
260 -- MISSION AREA SUB-TOTALS ---
261 DCA - AIRBORNE VEHICLES                       z
262 OCA - AIRBORNE VEHICLES                       z
263 MARITIME - AIRBORNE VEHICLES                  z
264 OCA - AIRFIELDS                               z
265 SEAD                                          z
266 C3CM                                          z
267 CAS - MOBILE TARGETS                          z
268 CAS - FIXED TARGETS                           z
269 AI - MOBILE TARGETS                           z
270 AI - FIXED TARGETS                            z
271 MARITIME - AIRFIELDS                          z
272 MARITIME - AI                                 z
273 ------------------------------------------------
274 ---- MISSION AREA TOTALS ----
275 COUNTER AIR AIRBORNE VEHICLES                 z
276 COUNTER AIR AIRFIELDS                         z
277 SEAD                                          z
278 C3CM                                          z
279 CLOSE AIR SUPPORT                             z
280 AIR INTERDICTION                              z
281 ------------------------------------------------
282 TOTALS                                        z

         "z" indicates calculated value
```

Figure H-5. Spreadsheet Subtotals

11. Aircraft Summary

This section draws from the SUB-TOTALS to summarize preliminary Planning Force calculations in one spot for easier review. Figure H-6 shows the summary section which is divided into major mission areas and summarized by the specific weapon systems which contributed to destroying the target base or were likely candidates to contribute to destroying the target base. As mentioned earlier, inputs for sorties required and number of aircraft are

	A		F	G	H	I	J	K	L	M	N
283											
284	1/19/1987										
285	KOREA AIRCRAFT SUMMARY	############	############	############	############	############	############	############	############	############	############
286			--- PF SORTIES--		PF AIRCRAFT ----		A/C REMAIN-----		ATTRITION		PH1/PH2
287	------- MISSION AREAS -------	A/C	PH 1	PH 2	PH 1	PH 2	PH 1	PH2	PH 1	PH2	+ATTRT
288											
289	COUNTER AIR	ATF	z	z	z	z	z	z	z	z	z
290	AIRBORNE VEHICLES	F-15A/D	z	z	z	z	z	z	z	z	z
291		F-15E	z	z	z	z	z	z	z	z	z
292		F-16A/D	z	z	z	z	z	z	z	z	z
293											
294	COUNTER AIR	A-7+	z	z	z	z	z	z	z	z	z
295	AIRFIELD ATTACK	F-15A/D	z	z	z	z	z	z	z	z	z
296		F-15E	z	z	z	z	z	z	z	z	z
297		F-16A/D	z	z	z	z	z	z	z	z	z
298		F/FB-111	z	z	z	z	z	z	z	z	z
299											
300	SEAD/C3CM	A-7+	z	z	z	z	z	z	z	z	z
301		A-10	z	z	z	z	z	z	z	z	z
302		F-15E	z	z	z	z	z	z	z	z	z
303		F-16A/D	z	z	z	z	z	z	z	z	z
304		F/FB-111	z	z	z	z	z	z	z	z	z
305		F-4G	z	z	z	z	z	z	z	z	z
306		FOWW	z	z	z	z	z	z	z	z	z
307		DRONES	z	z	z	z	z	z	z	z	z
308											
309	CLOSE AIR SUPPORT	A-7+	z	z	z	z	z	z	z	z	z
310		A-10	z	z	z	z	z	z	z	z	z
311		A-16	z	z	z	z	z	z	z	z	z
312		F-16A/D	z	z	z	z	z	z	z	z	z
313											
314	AIR INTERDICTION	A-7+	z	z	z	z	z	z	z	z	z
315		A-10	z	z	z	z	z	z	z	z	z
316		F-15A/D	z	z	z	z	z	z	z	z	z
317		F-15E	z	z	z	z	z	z	z	z	z
318		F-16A/D	z	z	z	z	z	z	z	z	z
319		F/FB-111	z	z	z	z	z	z	z	z	z
320		----------	----------	----------	----------	----------	----------	----------	----------	----------	----------
321	TOTALS		z	z	z	z	z	z	z	z	z

"z" indicates calculated value

Figure H-6. Aircraft Sortie/Sizing Summary drawn from the SUB-TOTALS section of the spreadsheet. Aircraft requirements are rounded off in the second (lower) SUB-TOTAL section to avoid ambiguities in subsequent rounding. Attrition for each aircraft by mission area is found by first determining the number of aircraft remaining at the end of each phase. Planning factors at the bottom of the spreadsheet are used to find this result. Attrition is calculated by subtracting aircraft remaining from aircraft starting the phase. A preliminary Planning Force result is the larger of the Phase I requirement or the Phase II plus attrition. There could be some question about a larger number of aircraft flying in Phase I with a higher attrition. This can be dealt with by assuming that only the Phase I requirement flies; any excess is placed in hold status until Phase II. This makes good the original Phase I attrition number. If reroling is not considered, the Planning Force is completely determined by summing the column labeled "PH1/PH2+ATTRT."

12. Wild Weasel Sortie Support

Figure H-7 shows the part of the spreadsheet devoted to Wild Weasel sortie support. The concept employed is to use the larger of Wild Weasel force sized against the target base, or sortie support for other aircraft. The following section sums sorties flown by other aircraft in airfield attack and air interdiction by phase. A support ratio is specified stating the number of sorties to be supported by a single Wild Weasel mission. The next factor is the percentage of that requirement to be met by the F-4G versus the FOWW. Phase requirements, attrition, and the "Planning Force (PF)" are determined as previously described, this time using supported sorties as the baseline. Note that several rows and spaces have been removed for a more compact depiction. The first row of figures is for airfield attack. The next row is for a "level of effort" support of close air support. This is calculated external to the spreadsheet by determining an orbit requirement using military judgment and

	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
285	WILD WEASEL SORTIE SUPPORT				##############								
286	SUPPRTD SORTIES		SUPPRT	% TO	------ F-4G ------				% TO	----- FOWW -------			
287	PH 1	PH 2	RATIO	F-4G	PH 1	ATTRT	PH 2	PF	FOWW	PH 1	ATTRT	PH 2	PF
289													
294	z	z	y	y	z	z	z	z	y	z	z	z	z
308													
309	LEVEL OF EFFORT CAS SUPPORT							y					y
313													
314	z	z	y	y	z	z	z	z	y	z	z	z	z
320	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------	-------
321								z					z

"y" indicates user input, "z" indicates calculated value

Figure H-7. Wild Weasel Summary

supporting those orbits at rates sustainable by F-4Gs or FOWWs. The next row of figures is for air interdiction and the last row provides totals.

13. Rerole

The next sections of the spreadsheet shown in Figures H-8 and H-9 perform rerole calculations. This involves using systems from sortie-intensive early phases of the conflict (counter air [CA], SEAD, and C3CM) in sortie-intensive later phases (close air support [CAS] and air interdiction [AI]). The rerole section calculates AI rerole first since this is the emphasis mission for rerole. Presumably, CAS is more sensitive to delays in prosecuting the mission. Phase I to Phase I Rerole (PH1-PH1 Rerole) is calculated first. This set of calculations uses aircraft finishing a short Phase I mission area (counter air [CA], SEAD, and C3CM) into mission areas with longer duration Phase I (CAS and AI). This is possible because the Phase II requirement for Counter Air, SEAD, and C3CM is quite small leaving a large number of idle aircraft that would be used elsewhere in an actual conflict. The methodology is fairly complicated, so it will not be described here. The basic idea is to determine how many sorties excess aircraft can produce, decide the minimum level of aircraft to start Phase I in AI and CAS (to be militarily prudent), and calculate the actual number of aircraft to rerole into AI and Close Air Support based on those inputs. The only input required from the user is in column I (labeled -4-). This is where the "50% rule" or other comparable rule is applied. The "50% rule" came about in early rerole efforts when military judgment deemed 50% of the original AI requirement to be prudent as a starting number at the beginning of the phase. This came up because there could be so many excess aircraft that all the Air Interdiction requirements could be accomplished in the last four days of Phase I by rerole aircraft. Obviously,

	A	B	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
323	REROLE - PHASE 1 TO PHASE 1			##												
324								PH1 REQ					REROLED		REMAIN	
325	------ FROM MISSION -----	-- TO MISSION		-- A/C -	-1-	-2-	-3-	-4-	-5-	-6-	-7-	-8-	-9-	-10-	-11-	-12-
326																
327	COUNTER AIR & SEAD	AI		A-7+	z	z	z	y	z	z	z	z	z	z	z	z
328				A-10A	z	z	z	y	z	z	z	z	z	z	z	z
329				F-15A/D	z	z	z	y	z	z	z	z	z	z	z	z
330				F-15E	z	z	z	y	z	z	z	z	z	z	z	z
331				F-16A/D	z	z	z	y	z	z	z	z	z	z	z	z
332				F/FB-111	z	z	z	y	z	z	z	z	z	z	z	z
333																
334	COUNTER AIR & SEAD	CAS		A-7+	z	z	z	y	z	z	z	z	z	z	z	z
335				A-10A	z	z	z	y	z	z	z	z	z	z	z	z
336				F-16A/D	z	z	z	y	z	z	z	z	z	z	z	z

"x" indicates user input, "z indicates calculatd value

Figure H-8. Phase I to Phase I Rerole

there would not be any AI sorties being flown in the first three days, which would not be prudent. Simply summarized, if the the original AI requirement was for 100 aircraft, a 50% rule would start Phase I with no less than 50 aircraft in AI regardless of how many rerole aircraft might be available. The legend attempts to describe the calculations in the corresponding columns. Several planning factors from the bottom of the spreadsheet are required to determine sortie availability and requirements. As for user interface with this section of the spreadsheet, this is accomplished with column "-4-" as previously mentioned. This can be left at a "50% rule" if that is appropriate. If more aggressive rerole is desired (which will decrease the total force size), a smaller percentage should be specified. An entry of "0%"

```
    :     A      :: B :: C ::   D   ::   E  :: F :: G ::   H :: I :
337 REROLE - PHASE 1 TO PHASE 2                    #######################
338                                                PH2 REQ REROLED#REMAIN
339 ---- FROM MISSION ---- TO MISSION --- A/C -   -13-   -14-    -15-   -16-
340
341 COUNTER AIR & SEAD      AI          A-7+        z      z       z      z
342                                     A-10        z      z       z      z
343                                     F-15A/D     z      z       z      z
344                                     F-15E       z      z       z      z
345                                     F-16A/D     z      z       z      z
346                                     F/FB-111    z      z       z      z
347
348                         CAS         A-7+        z      z       z      z
349                                     A-10        z      z       z      z
350                                     F-16A/D     z      z       z      z
351 LEGEND
352  -1-  REROLE AIRCRAFT AVAILABLE - PHASE 1 TO PHASE 1
353  -2-  SORTIES AVAILABLE FROM REROLE AIRCRAFT IN PHASE 1
354  -3-  PH 1 A/C REQ BEGIN PH1 IF ALL A/C ARE REROLED (- =EXCESS CAPABILITY)
355  -4-  50% RULE (USER SHOULD SUBSTITUTE ANY DESIRED RULE)
356  -5-  PH 1 REQUIREMENT AFTER REROLE (50% RULE OR COMPARABLE APPLIED)
357  -6-  PH 1 AIRCRAFT REMAINING AT END OF DAY 3
358  -7-  PH 1 SORTIES ACCOMPLISHED BY END OF DAY 3
359  -8-  PH 1 SORTIES REMAINING FOR DAYS 4-7
     -9-  PH 1 FORCE REQUIRED BEGINNING DAY 4 FOR DAY 4-7 SORTIES
    -10-  COUNTER AIR/SEAD AIRCRAFT SELECTED TO REROLE - PHASE 1 TO PHASE 1
     11-  AC REMAINING AT END OF PHASE 1
     12   AC AVAILABLE FROM REROLE POOL (INCLUDES UNUSED REROLED AIRCRAFT)
     13   REROLE AIRCRAFT AVAILABLE - PHASE 1 TO PHASE 2
     14-  PH 2 REQUIREMENT AFTER REROLE
     15   AIRCRAFT SELECTED TO REROLE - PHASE 1 TO PHASE 2
     16   # OF AIRCRAFT AVAILABLE IN REROLE POOL

                  "z" indicates calculated value
```

Figure H-9. Phase I to Phase II Rerole

will enable maximum rerole. If it is desired to inhibit rerole altogether, this can be accomplished by entering 100%, requiring 100% of the original Phase I requirement at the beginning of Phase I. Phase I-Phase II rerole is calculated in the spreadsheet as shown in Figure H-9.

14. Planning Force Summary Table

The summary table in Figure H-10 shows an example of aggregated totals based on the different assumptions which could be used in force sizing. The largest force will result from simply adding Phase I and Phase II requirements for each aircraft in each mission area. This is not very realistic since leftover Phase I aircraft will be used in Phase II in any event. The next largest force sums the individual Phase I or Phase II plus attrition (whichever is larger). This was the method prior to the FY 94 Planning Force. A force smaller still results if only Phase I requirements are totaled. This is effective for conflicts with a single phase or conflicts with very large Phase I requirements. It ignores the possibility of large Phase II requirements in selected mission areas and target categories. The smallest force is sized by considering both PH1-PH1 and PH1-PH2 rerole. This is the force table used in summarizing the USAF Planning Force. The rounding check was added since various audiences expect fighter results to be reported in tactical fighter wing equivalents (72 aircraft per wing equivalent). If the individual mission areas are rounded off, the sum of these rounded figures may or may not add to the number of wing equivalents calculated by dividing the

	A	B	C	D	E	F	G	H
379	KOREA FY 91-98 PLANNING FORCE							
380	1/19/1987		PH1-PH1 AND PH1-PH2 REROLE					
381	**							
382	* AIRCRAFT	A/A	AFA	SEAD	CAS	AI	TOTAL	*
383	* ATF	z	z	z	z	z	z	*
384	* F-15A/D	z	z	z	z	z	z	*
385	* F-16A/D	z	z	z	z	z	z	*
386	* A-7+	z	z	z	z	z	z	*
387	* A-10	z	z	z	z	z	z	*
388	* A-16	z	z	z	z	z	z	*
389	* F-15E	z	z	z	z	z	z	*
390	* F/FB-111	z	z	z	z	z	z	*
391	* F-4G	z	z	z	z	z	z	*
392	* FOWW	z	z	z	z	z	z	*
393	* TOTALS	z	z	z	z	z	z	*
394	* WING EQV	z	z	z	z	z	z	*
395	**							
396					ROUNDING CHECK		z	

"z" indicates calculated value

Figure H-10. Planning Force Summary

total aircraft in a theater by 72. Seemingly, it is too difficult to explain why these numbers do not add up, so adjustments to the mission areas are required to keep the audience happy. It would seem more logical to report the results in numbers of aircraft and avoid the problem altogether.

15. Planning Factors

The final section of the spreadsheet contains the various planning factors for use in other portions of the spreadsheet. See Figure H-11. This section maintains attrition rates, sortie rates, PSEs, and phase lengths, and calculates the expected sorties available from a particular aircraft given the other data. A detailed explanation of the sizing formula used in these calculations is located in Annex G. The presentation was divided to fit on the printed page. Since several kinds of information are contained on the

A	B	C	D	E	F	G
399						
400 MISSION AREAS (PSEs)		---PHASE LENGTHS--			ATTRITION	----
401		PH 1	PH 2			DAYS
402 AIR-TO-AIR--						
403 DEEP ATTACK		z	z		A-A	1
404 DIRECT SUPPORT		z	z			2
405 HOMELAND DEFENSE		z	z			3
406 SOVIET NAVAL AIR		z	z			4-7
[illegible]						8-30
[illegible]						31-
[illegible] GROUND --						
[illegible] RBASES		z	z		A-G	1
[illegible]		z	z			2
[illegible]		z	z			3
[illegible]		z	z			4
[illegible]		z	z			5
[illegible]		z	z			6-7
[illegible]		z	z			8-30
						31-
					A-G	4
					SHORT	5
					PH 1	6-7
						8-30
						31-
					A-G	4
					REROLE	5
						6-7

"z" indicates calculated value

[illegible] anning Factor Title Section

same line, there area several sets of titles. The Mission Areas for PSEs are shown in column A. Actual PSE numbers for this example start in cell M410. Next, the phase lengths for the various mission areas are specified although these are for information only; they are not used in the calculations. Next is the title section for attrition rates which will be summarized for each aircraft type. The next section of the table shows figures for the A-7+. Data for other aircraft is analogous. First the sortie rates are recorded. For the Planning Force, these are WMP-5 high surge sortie rates (6:--). Next, the attrition rates are recorded. These are WMP-5 figures for the Planning Force (6:--). The next two columns calculate the probability of survival of an aircraft flying the indicated sortie rates with the indicated attrition. This is calculated for the day or period in question as well as for cumulative

	H	I	J	K	L	M	N	O	P
399	A-7+ -----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------
400	SORTIE	ATTRIT	DAILY	CUM	SORTIES-------	PSE	----	SORTIES	PER AC
401	RATE	RATE	P(s)	P(s)	PER A/C	PH 1	PH 2	PH 1	PH 2
402	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------
403	y	y	z	z	z	y	y		
404	y	y	z	z	z	y	y		
405	y	y	z	z	z	y	y		
406	y	y	z	z	z	y	y		
407	y	y	z	z	z				
408	y	y	z	z	z				
409	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------	-----------
410	y	y	z	z	z	y	y	z	z
411	y	y	z	z	z	y	y	DAY1-7	DAY8-
412	y	y	z	z	z	y	y		
413	y	y	z	z	z	y	y		
414	y	y	z	z	z	y	y		
415	y	y	z	z	z	y	y		
416	y	y	z	z	z	y	y		
417	y	y	z	z	z				
418									
419	z	z	z	z	z			z	z
420	z	z	z	z	z			DAY1-3	DAY4-
421	z	z	z	z	z				
422	z	z	z	z	z				
423	z	z	z	z	z				
424								PH 1A	PH 1B
425	z	z	z	z	z			z	z
426	z	z	z	z	z			DAY1-3	DAY4-7
427	z	z	z	z	z				

"y" indicates user input, "z" indicates calculated value

Figure H-11b. Planning Factors

periods. These figures are required to determine the expected sorties per aircraft. The next column uses the force sizing formula described in Annex D to calculate the sorties available for an aircraft flying on the indicated day(s). The next two columns contain the PSEs which are used to determine sortie requirements in the interior of the spreadsheet. The columns labeled "SORTIES PER AIRCRAFT" simply add the component sortie capabilities for the desired period. These are the planning factors which determine the required number of aircraft from the the number of sorties required to destroy a particular target set.

16. Minimum Risk Force Versus Planning Force

The MAJCOM planner may well ask how to transform the Planning Force spreadsheets into those representing a "virtual assurance of success." The variables open to modification are: target counts, phase objectives, expected kills per sortie, aircraft contribution factors, sortie rates, attrition rates, and PSEs.

a. Target Counts. AF/IN and AF/XOXFW have scrubbed the target counts in the AFPG III over the course of several months. Numbers corresponding with existing target lines are best left alone. However, MAJCOMs might need to add entirely new target lines. This can be done by inserting rows in the spreadsheet, manually entering target data, and replicating sizing formulas.

b. Phase Objectives. AF/XOXFW Phase Objectives are constructed to provide a "reasonable assurance of success." Consequently, these are fair game for modification. However, Phase Objectives totaling *more* than 100% would be suspect unless there was an overwhelming reason for "overkill."

c. Expected Kills per Sortie. This is another excellent candidate for modification. The EKSs (or BKs) used for the Planning Force are derived from extensive use of preferred/advanced munitions. The MAJCOMs might well reduce the EKSs to something representative of current munitions. The only problem here is that each aircraft/target combination requiring update would have to be separately weaponeered.

d. Aircraft Contribution. This is another factor subject to MAJCOM judgment. The assignment of various aircraft against individual target lines has been called the "Concept of Employment" for the Planning Force. MAJCOMs can adjust this in any manner they desire. This is done by manually entering numbers in the "% CONTRIB" column for individual aircraft, replicating formulas if none exist for that aircraft/target combination, and checking that *no more* than a 100% Total Contribution to target destruction (except in unusual cases).

e. Sortie Rates. This is the most likely candidate for change when producing Minimum Risk Forces. Since the Planning Force uses WMP-5 High Surge sortie rates, the MAJCOMs would do well to use normal WMP-5 rates, or better yet, OPLAN sortie rates for their individual theaters.

f. Attrition Rates. This is the next best candidate for update. The Planning Force is compelled to use WMP-5 attrition rates. A problem with updating the attrition rates is a credible source for the new numbers.

g. PSEs. These are very complex factors best left alone.

17. Conclusion

At first blush, this spreadsheet may appear quite complicated. However, the underlying concepts are fairly simple when taken individually. The time it takes to learn the spreadsheets is well worth it. Each spreadsheet can calculate Planning Force results in about 90 seconds--a process that took several weeks by hand.

Annex I

HELPFUL HINTS FOR BRIEFINGS

1. This annex is a short summary of helpful hints when preparing for briefings to the Air Force Board Structure. These are covered from the perspective of the Air Staff project officer and the MAJCOM planner.

2. Air Staff Project Officer. Briefings for the panels are fairly straightforward. Check with AF/CVSB for the number of paper copies of the briefing required prior to the briefing. While this number varies, you can probably be safe with 20 copies delivered to CVSB a day or two before the briefing. If the briefing is slipped for some reason, it might be prudent to retrieve the briefings since CVSB has been known to pitch them. Briefings to the Force Structure Committee (FSC) and Program Review Committee (PRC) require 25 copies. Both the FSC and PRC will require Memos describing the briefings as well as advance copies. The Air Staff Board and Air Force Council briefings are handled with individual tasking sheets that describe briefing requirements. The AF/XOX executive must submit a request for presentation to the Air Staff Board while the AF/CVS executive must do the same for the Air Force Council. Memos and books are required for AF/XOX for the Air Staff Board (and AF/XOO if AF/XOX is the designated Board representative) and for AF/XO for the Air Force Council. The number of advance paper copies is specified on the tasker. The Board and Council both require brief sheets which are distinct from the memo previously discussed. Once again, the tasker describes what is required. Requirements for briefing the CSAF and SecAF are less formal. Memos are required for those briefings with enough paper copies of the briefing for the principals. Five copies would have been enough for the FY 90-97 Planning Force briefing although 10 were supplied.

3. MAJCOM Planners. The preceding paragraph gives some insight into the Air Staff penchant for surplus paper. When traveling to brief the Air Staff, the prudent planner will bring a clean paper copy of the briefing. Copy facilities at the Air Staff can be used to reproduce the briefing. One hint--briefings prepared with "negative" slides, i.e., black background and white letters, tend to trash out the copiers. Bring a clean original from which the negative was shot to reproduce.

4. Annex I has presented some useful tips for briefings at the Air Staff.

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GLOSSARY

ACTS	Air Corps Tactical School
AFFTL	Air Force Future Targets List
AFPG III	Air Force Planning Guide, Vol. III, Threat
Air Staff	Headquarters, United States Air Force
ANSER	Analytical Services, Inc.
AWPD	Air Staff Air War Plans Division (WWII)
AWPD-1	Air War Plans Division, Plan 1
BA	Blue (friendly) attrition
BG	Blue (friendly) goal, % of targets which must be destroyed to accomplish military objective
BK	Blue Kills (preferred term is expected kills per sortie)
BS	Blue (friendly) share, % of targets which are USAF responsibility
BSR	Blue (friendly) sortie rate
C3CM	Command, control, and communications, countermeasures
CINC	Commander in Chief
CY	Calendar year
D	Length of phase (usually in days)
DCA	Defensive counter air
DG	Defense Guidance
EC	Electronic combat
EKS	Expected kills per sortie, effectiveness of a weapon system/weapon combination against a particular target
FP&P	OJCS/J-8, Force Planning and Programming Division
FSC	Force Structure Committee
FY	Fiscal Year
JCS	Joint Chiefs of Staff
JMEMs	Joint Munitions Effectiveness Manuals
JSPD	Joint Strategic Planning Document (JCS input to DG)
JSPDSA I	Joint Strategic Planning Document Supporting Analysis, Part I (provides scenario, timing and format of MRF/PF inputs)
JSPDSA II	Joint Strategic Planning Document Supporting Analysis, Part II (U&S command MRFs)
[illegible]	Joint Strategic Planning Document Supporting Analysis, Part III, [illegible] Planning Force

MAA	HQ USAF/XOXFW, Mission Area Analysis
MAJCOM	Major Command
MOP 84	JCS Memorandum of Policy, No. 84, Joint Strategic Planning System
MRF	Minimum Risk Force
N	Number of aircraft required
NCAA	Nonnuclear Consumables Annual Analysis
NSNF	Nonstrategic Nuclear Forces
OCJS	Organization of the Joint Chiefs of Staff
PF	Planning Force
Phase OBJ	Phase objective (% of targets to be destroyed)
PSE	Partial sortie effectiveness
S	Sorties (required to destroy assigned targets)
SAF/AQQT	Fighter Requirements Division
SEAD	Suppression of enemy air defenses
SOF	Special operations forces
SON	Selector Output of Nonnuclear Consumables Annual Analysis
TAC C2	Tactical command and control
U&S	Unified and specified commands
WMP-5	USAF War and Mobilization Plan, Vol. 5
XOXF	Deputy Directorate for Force Development, Directorate of Plans, DCS P&O, HQ USAF
XOXFD	Strategic Defense and Space Forces Division
XOXFL	Mobility and Special Operations Division
XOXFM	Munitions Plans Division
XOXFS	Strategic Offense Division
XOXFT	Tactical Forces Division
XOXFW	Mission Area Analysis (MAA)

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